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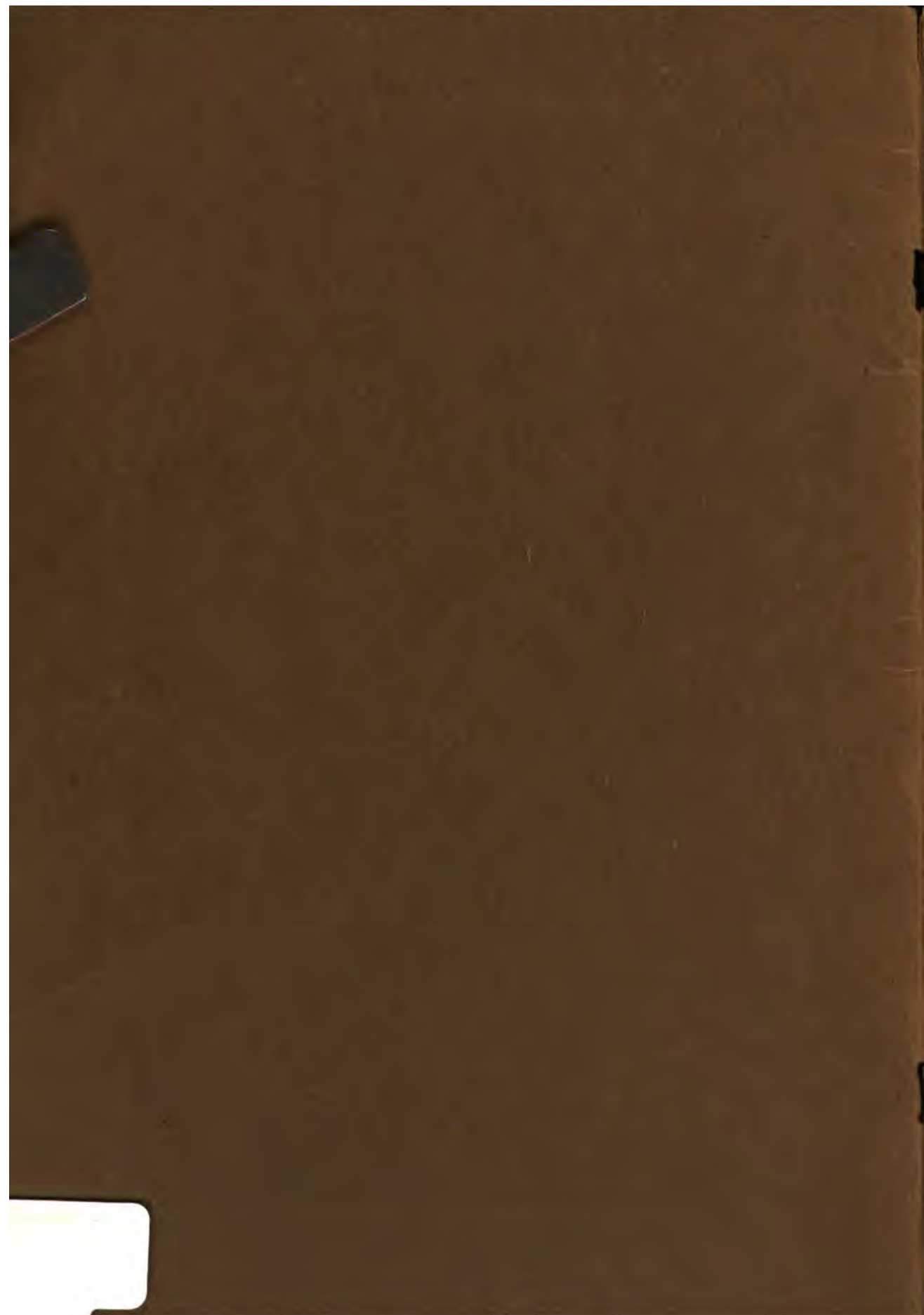
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PRELIMINARY STUDY
OF FAMILY RESEMBLANCE
IN HANDWRITING

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PRELIMINARY STUDY OF FAMILY RESEMBLANCE IN HANDWRITING

I. HUMAN INHERITANCE.

In the biological discussion of heredity, attention has been concentrated largely upon non-human inheritance, data for the study of which have been gathered from observation of plant and animal life. Little attention has been given to the problem of human inheritance. The former problem, so much less complicated than the latter, and of such great practical importance in the breeding of animals, is open to direct observation in a few or many generations and in certain aspects lends itself so readily to experimentation that it is little wonder that work should have commenced here rather than with human inheritance.

None the less, popular interest in the resemblance between the members of the same family has always been great. Literature, history and anecdote have preserved a certain amount of material that has attracted attention. Moreover, modern work in scientific sociology has brought to realization the immense importance of an understanding of the laws of human inheritance if society is ever to succeed in solving certain pressing difficulties. The adoption of proper social regulations, not to speak of educational ideals, must depend upon an accurate understanding of the relation between character and inheritance and character and environment. The effects of inbreeding and the possible inheritance of disease must be determined by an understanding of the laws of heredity. The modern movement of Eugenics seeks definitely to arouse the public conscience as to the importance of cultivating and elevating the human breed in accordance with the generalizations of science. The movement points a growing interest of the times.

A brief résumé of the methods employed in the study of human inheritance may be of value. First of all, a distinction must be drawn between physical inheritance and mental and moral inheritance. The first would deal with such details of the physical make-up as stature, color of hair and eyes, cephalic index and the like. The latter would be concerned with such mental characteristics as musical capacity, memory, power of reasoning and such moral traits as generosity and industry. Of course, in a comprehensive research a further attempt would be made, namely, to correlate physical and mental inheritance, to show, for example, that delicacy in tactile discrimination—a mental trait—accompanied great flexibility of the hand—a physical trait.

Research in human inheritance offers, as has been previously suggested, great difficulties, the principal one being the difficulty of obtaining accurate data covering more than two or three generations. Such a difficulty can, of course, be overcome by the keeping of records for future use. Again, this difficulty may be overcome to a certain extent by the application of the methods of statistics to a large number of persons and the attempt to deal with fraternal resemblance rather than with paternal resemblance.

blance. The second difficulty is that of determining human traits which permit accurate measurement. This second difficulty is much less insistent in dealing with physical than with mental inheritance and, accordingly, we have excellent studies on the laws governing the inheritance of stature, eye-color, and other physical traits, while accurate studies upon the inheritance of mental and moral traits are still lacking, although the ground has been broken. Moreover, the development by quantitative psychology of methods of mental mensuration is very encouraging.

1. *Methods of Investigation.*

Before a detailed discussion of the methods of study of human resemblances is given, those methods may be roughly described as descriptive, statistical, and analytical.

(A) THE DESCRIPTIVE METHOD.

The earlier treatments of the subject of human inheritance were largely descriptive. Such a treatment, for example, is found in Ribot's book entitled "*Heredity*" (16), the first edition of which was published in 1873. The author's purpose was to gather from history and scientific reports instances showing the transmission of some trait or other. The whole range of mental characteristics is covered from inheritance of sensorial qualities, such as undue sensitivity to tickling, to the inheritance of artistic and volitional aptitudes. This descriptive treatment is supplemented by what Ribot calls the "*Laws of Heredity*," including (1) Direct Heredity, where the child takes equally after both its parents (blended inheritance) or, as is more frequently the case, where it resembles more specifically one of the two parents, which results at times in cross-heredity, in which the son resembles the mother and the daughter the father; (2) Reversional Heredity or Atavism, which occurs frequently between grandfather and grandson, grandmother and granddaughter; and (3) Collateral, or Indirect, Heredity, which consists in resemblance between individuals and their ancestors in the indirect line. Ribot also considers apparent exceptions to the laws of heredity in relation to the so-called "*Law of Spontaneity*."

(B) THE STATISTICAL METHOD.

The application of the statistical method in the study of human inheritance was first attempted by Galton in the '60's.

Galton was interested in establishing, in his book entitled "*Hereditary Genius*" (8), a standard scale of human ability. To do this, he made use of the well-known Law of Error, or Deviation from the Average, a law which states that deviations center about a mid-point and are equal in number above and below the mean. By careful analysis of biographical data, Galton estimated the number of "eminent" men at a given time to be as 250 in a million, or as one to four thousand. The "illustrious" men would be still more rigidly selected as one to a million or to many millions. Working downward, Galton obtained his measure of mediocre or average ability, below which he determined a descending scale corresponding to the ascending one and ending with idiots, about 280 to a million. Galton argued that if it should be found that "eminent" or "illustrious" men are clustered in families, the conclusion would be that ability is hereditary in these families. Such a conclusion Galton reaches after a detailed study of the families of English Judges, the families of Statesmen, Commanders, Literary Men, Men of Science, Poets, Musicians, Painters, and Divines. He says further: "The general uniformity in the distribution of ability among the kinsmen in the different groups is strikingly manifest. The eminent sons are almost

invariably more numerous than the eminent brothers, and these a trifle more numerous than the eminent fathers. * * * We come to a sudden dropping off of the numbers at the second grade of kinship, namely, at the grandfathers, uncles, nephews, and grandsons. * * * On reaching the third grade of kinship, another abrupt dropping off in numbers is again met with, but the first cousins are found to occupy a decidedly better position than the other relations within the third degree." (8:309.)

Galton's studies were continued in "Natural Inheritance" (10). He worked out in further detail the Law of Deviation from the Average and applied it specifically in a discussion of resemblances among related persons in stature, eye color, artistic faculty, and disease. A detailed application was found to necessitate a transmutation of female into male measures in order to determine the position of the mid-parent. Galton distinguishes between the parental center and the racial center, from both of which variations occur in both directions and works out his law of regression. "Each peculiarity in a man is shared by his kinsmen, but *on the average* in a less degree. * * * This apparent paradox is fundamentally due to the greater frequency of mediocre deviations than of extreme ones, occurring between limits separated by equal widths." (10:194.)

In general, Galton's name is associated with the so-called "Law of the Average Contribution of each separate Ancestor to the Total Inheritance of the Offspring." Put briefly, this law states that the parents each contribute one-fourth to the inheritance of an individual, the grandparents one-sixteenth each, the great-grandparent one-sixty-fourth, and so on in an infinite series.

The statistical method has been still further developed by Karl Pearson. The Huxley lecture, delivered by him in 1903, was entitled, "On the Inheritance of Mental and Moral Characters in Man and Its Comparison with the Inheritance of the Physical Characters" (15). In this investigation Pearson confined himself to fraternal resemblance because of the ease with which material could be collected under such conditions. From 800 to 1,000 pairs of brothers and sisters were classed by teachers under Pearson's directions. The mental characters selected for measurement were general ability, vivacity, assertiveness, introspection, popularity, conscientiousness, temper, and handwriting. The following conclusions were drawn: "The physical and psychical characters in man are inherited within broad lines in the same manner, and with the same intensity" (15:204). Again, "By assuming our normal distribution for the psychical characters we have found, not only self-consistent results—linear regression, for example, as in the case of inheritance of intelligence, but we have found the *same* degree of resemblance between physical and psychical characters. That sameness involves something additional. *It involves a like heritage from parents*" (15:204). The fraternal and paternal resemblance is found roughly to be about .5 for both physical and psychical characters. Pearson warns the reader that the quantitative results so obtained apply only to the averages of a large number, not to individual cases.

Thorndike has carried out a similar investigation upon fifty pairs of twins (19). He found the resemblance of twins in the traits studied to be approximately .80 or .75 to .80 in amount, a much stronger resemblance than he found to exist between pairs of brothers and sisters who were not twins.

The attempt to work out, quantitatively, coefficients expressing the resemblance for different degrees of kinship is closely related in the methods used to Correlational Psychology, which seeks to determine the coefficient of correlation between different mental traits in the same individual, the correlation, for example, between all forms of Sensory Discrimination and General Intelligence. The requirements of a good method for

such work and criticisms on much of the earlier investigation because of failure to reach precise quantitative expression are given by Spearman (18). Spearman's criticism holds, likewise, but to a lesser degree, for some of the correlation coefficients that have been established in the study of human inheritance.

One of the most interesting attempts to deal with human inheritance is that of Woods in his recent book, "Mental and Moral Heredity in Royalty" (21). The author conducted his investigation with such fundamental questions in mind as the part played by heredity and environment in determination of mental and moral characteristics, the effect of inbreeding, the relation of genius to insanity and sterility.

In dealing with large averages, Woods accepts Galton's Law of the Average Contribution of each Separate Ancestor to the Total Inheritance of the Offspring in order to compare facts concerning a large number of individuals of known pedigrees with the expectations arising from heredity. Should the expectations be confirmed, the conclusion must be drawn that mental and moral characters are the outcome of heredity rather than of environment or free will. Woods' conclusion is that to a startling extent the facts found are those which heredity would lead us to expect. He finds, however, "that both mental and moral qualities more often than otherwise do *not* thoroughly blend, but give us many examples of at least partial alternative inheritance" (21:274) in consequence of which "a child is apt to 'take after' rather completely one of his ancestors, more often the near one, less and less often the remote one, until the chances of reversion to a very distant one are exceedingly slight." * * * "Once in a large number of times occurs one of those fortuitous combinations of ancestral qualities that is destined to make a person inheriting them vary much from any of kin, and in fortunate instances shine as a genius springing from a mediocre stock" (21:298 f.).

Woods has been unable to detect the existence of "dominant" or "recessive" types, although his method of research is more analytical than is the usual statistical investigation.

To avoid error arising from unconscious preference in the choice of cases, Woods chose individuals merely by blood relationship and compiled practically complete records of pedigrees. The possibility of obtaining such complete records is almost confined to royal families, which accounts for Woods' selection of material. Furthermore, it is not difficult to obtain historical estimates of the mental and moral characteristics of royalties. In making such estimates, Woods adopted a system of grading from (1) the lowest, to (10) the highest, a grading being made separately for intellectual and for moral characteristics. The Law of Deviation from an Average was utilized also. In all, 832 characters were studied.

Woods' conclusion is that environment is a totally inadequate explanation of the intellectual life. He shows that, on the whole, maximum fertility is found with general superiority; that neither luxury nor frequent intermarriages produce degeneracy; that there is a slight relationship between genius and insanity. Woods also made an attempt to correlate mental ability with moral worth, probably the first attempt that has been made. He is satisfied that he has proved "that the morally superior are also the most endowed mentally."

(C) THE ANALYTICAL METHOD.

Strongly opposed to the statistical treatment of the facts of inheritance is the attempt to study the segregation and transmission of unit-characters and to determine the laws of dominance and of recession. Of Galton's Law, Bateson—who may be allowed to speak for the followers of Mendel—writes, "His formula should in all probability be looked upon rather as an

occasional consequence of the actual laws of heredity than in any proper sense one of those laws" (1:6). According to Galton's Law every ancestor is supposed to have some effect upon the composition of a family, a view irreconcilable with a belief in segregation or "dissociation of characters from each other in the course of the formation of germs." The non-analytical method of Pearson and the English Biometricians is definitely rejected by Bateson, as are all methods that dispense with individual analysis of material.

The study of the transmission of unit-characters in animal and plant descent has lent itself so readily to experimental treatment that it is little wonder that the biologists have, to a great extent, confined themselves to such work rather than attempted an application of Mendelism to human inheritance. Not only is it difficult to get complete human pedigrees, which the application of the analytic method demands, but it is also extraordinarily difficult to determine a unit-character. Bateson in his recent book, "Mendel's Principles of Heredity" (1), summarizes the conclusions that have been reached relative to the application of Mendelism to human inheritance. It has been shown that there is Mendelian inheritance of eye-color, and that "brown" eyes are dominant to "blue". The inheritance of hair-color is less satisfactorily worked out, although apparently there is a segregation of red hair from brown, with red as a recessive.

The existence of Mendelian inheritance in the case of abnormal characters is more clearly evident than its application in the case of normal features. Nearly all abnormal features that have been shown to follow Mendelian inheritance are found dominant to the normal. The following abnormalities obey Mendelian rules: Brachydactylism (shortening of the fingers or toes), cataract, various affections of the skin and hair, congenital stationary night-blindness. All of these abnormalities were dominants and hence transmitted only through affected persons. Certain sex-limited peculiarities have also been shown to follow Mendelian inheritance, although these cases are complicated by the fact that the peculiarity investigated, such as color-blindness for instance, is usually dominant in males and recessive in females. Color-blindness may, therefore, be transmitted by affected males or unaffected females.

It is so difficult to trace recessive variations in man, because they are frequently transmitted through unaffected persons, that the records of diseases apparently showing such recession are suggestive rather than conclusive. As recessive characters are likely to appear in the families resulting from consanguineous marriages, records of such families are of great value.

The only attempt, so far as I know, to apply Mendelian interpretation to a strictly mental trait is found in Hurst's observation "that the musical sense is a Mendelian character, recessive to the non-musical character which is dominant" (13:47).

It will be seen that Mendelism demands critical and minute analysis of material. The massing of results is fatal to understanding them. If, for example, in eye-color, "blue" be the recessive and "brown" the dominant trait, the blue-eyed child shows the inheritance of a pure type of eye-color and represents a different possibility of transmission from his brown-eyed brother, who may either be pure in type or capable of transmitting blue-eyedness as well as brown-eyedness. Mendelian inheritance if found to apply generally to human inheritance would lead to important conclusions, for in the case of inheritance of a pure type there would be no possibility of reversion. Knowledge of the transmission of diseases bids fair to increase our understanding of them and to contribute to social control.

Statistical methods, as previously stated, have been more extensively applied in the study of human inheritance, analytical methods in the study of non-human inheritance. Usually, it must be said, the mental traits chosen for study of inheritance have been selected on the basis of a popular and non-critical use of classificatory terms. Thus, to the psychologist the term "memory" covers such a multitude of facts that an attempt to trace the inheritance or non-inheritance of such a so-called "faculty" seems somewhat indiscriminating. More careful analysis of traits is demanded.

The present study makes no pretense of applying either the statistical or the analytical method to the study of handwriting. In a general way, the treatment is descriptive merely,—an attempt to break ground, to determine whether or not the handwritings of related persons show resemblances.

My interest in the subject was aroused somewhat accidentally by my noticing upon the college bulletin board a signature very similar to that of U. S. Grant which I had recently been studying. It was the signature of Mortimer N. Grant, Jr., a distant cousin of the great President. Plate I gives Mr. Grant's signature with that of his father (first cousin once removed to U. S. Grant), and a reproduction of President Grant's autograph. The similarity is striking.

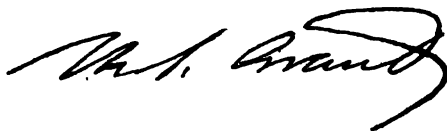

A cursive handwritten signature of U. S. Grant, featuring a large, sweeping 'G' and a distinct 'U' at the beginning.A cursive handwritten signature of M. N. Grant, Jr., which is very similar in style to the signature of U. S. Grant above it.A reproduction of President Grant's autograph, showing a highly stylized and complex cursive signature.

PLATE I.

The "Grant Family History" (12), which Mr. Grant kindly procured for me, shows a resemblance in the signatures of many members of this great family organization. Mr. Grant informs me, however, that frequently this similarity is confined to the autograph. One cannot, therefore, without further investigation, cite this as a case of inheritance of handwriting. The resemblance involved may be a very subtle effect of the operation of the law of suggestion.

II. THE INHERITANCE OF HANDWRITING.

1. *Historical Orientation.*

The belief that there is often a similarity between the handwritings of different members of the same family is an old one. The classic reference is to Darwin, who writes: "On what a curious combination of corporeal structure, mental character, and training must *handwriting* depend! Yet every one must have noted the occasional close similarity of the handwriting in father and son, although the father had not taught his son. * * * Hofacker, in Germany, remarks on the inheritance of handwriting, and it has even been asserted that English boys, when taught to write in France, naturally cling to their English manner of writing" (5). Carpenter, who quotes this passage in his "Mental Physiology" (4:372), adds that he has been assured by Miss Cobbe that a very characteristic type of handwriting is in her family traceable through five generations.

Galton takes it for granted that handwriting runs strongly in families, but states the curious fact that in his study of twins he found a similarity in handwriting to be rare, such dissimilarity being in certain cases the only point of difference observed (9:220).

In proof of the alleged "constitutional" character of handwriting, attention is called to the fact that the left-handwriting, mirror-writing and foot-writing of a given individual are found to resemble his right-handwriting. The individualistic character is preserved. Theoretically, there is no reason why motor peculiarities should not be transmitted as well as sensory ones. Galton's study of the families of wrestlers and oarsmen gave him reason to believe that strength and skill are hereditary (8:296 f.). And Bateson has shown that among horses there are natural pacers and natural trotters, and that "pacing is recessive to the ordinary trotting gait in the American trotter" (1:32).

C. N. Mitchell, in an article on "The Making of Handwriting," contributed to "Knowledge and Scientific News" (14), accepts unhesitatingly the opinion that individuality in handwriting is hereditary, and states further "that there is frequently a tendency for the sons to inherit certain characteristics in the father's handwriting, and for the daughters' writing to resemble more closely that of their mother than that of their father" (14:255). An illustration is offered of the handwriting of father, mother, four daughters and three sons which actually shows the tendency to which the author refers. The article is, however, a summary of interesting observations that have been made upon handwriting rather than an original contribution to the subject.

Pearson in his investigation upon fraternal resemblance, which has already been cited (15), included handwriting among the mental traits examined. The handwriting of the children under investigation was graded by the teachers as Very Good, Good, Moderate, Poor, Bad, and Very Bad. Moreover, a specimen of the handwriting of each child was obtained. The coefficient of correlation was found to be .53 for brothers, .56 for sisters, and .48 for brother and sister. Although it may be necessary to discard the statistical in favor of the analytic method of investigation, Pearson's conclusions in any case have suggestive value. He finds, for example, a very sensible correlation between psychical characters and handwriting, but only very moderate or zero correlations with the physical characters (15:200). A further communication relative to the correlation of handwriting with particular mental traits is promised, but such a communication, so far as I am aware, has not yet been published.

Pearson's conclusion that handwriting should be classed as a mental rather than a physical character is interesting in connection with attempts to determine whether incoördinated or inaccurate writing is due to physical

peculiarities or to mental characters, such as indistinct visual imagery or distraction of attention. Gessell (11), who sums up the evidence, finds that while all attempts to correlate handwriting peculiarities with details of the structure of the hand have been abortive, still there is some evidence to show that the character of handwriting depends upon inherited physical traits. In his own investigation of the handwriting of school children, Gessell found in the primary grades a correlation of school intelligence with accuracy in handwriting. Above the primary grades this correlation was cut by sex differences, inasmuch as the girls showed greater accuracy in handwriting than did the boys, an accuracy due, in Gessell's opinion, to their preoccupation with a visual image or copy. My own experiments upon the control processes in handwriting (7) points to a dependence of handwriting appearance upon the specific control processes utilized. I do not find, however, that visual control necessarily produces the most effective results. In any case, it appears that both physical and mental peculiarities determine the character of handwriting.

This is exactly what one would expect in view of the modern conception of the intimate relation between consciousness and movement. Viewed objectively, movement is simply a physical fact, but it is not only expressive of conscious states, it also serves as a stimulus to consciousness and contributes an essential factor to such mental complexes as rhythm, sentiment, mental imagery, etc. Bentley (2) has shown that there are psychologists who find the character of consciousness determined by the "interplay of motor mechanisms" and psychologists who find consciousness primarily engaged in determining motor adjustments. In either case we may expect to find that motor peculiarities furnish an index of mental and emotional temperament. Not that one need anticipate, necessarily, that motor skill or quick reaction should be correlated with general intellectual ability. The relation between consciousness and motor activity may well be too subtle to be disposed of in such a summary fashion. Probably one should first attempt correlation of habits of attention and motor habits or correlation of temperamental traits and motor peculiarities.

Handwriting is, of course, an exceedingly complicated motor activity and the need of complete analysis which has been insisted upon as so necessary in a consideration of the inheritance of mental traits is also to be insisted upon in this connection. Writing-speed, pressure, slant, size and formation of letters must be separately investigated. Fortunately, a technique for the minute analysis of the writing act is being worked out. Meanwhile, it is possible that a rough study of resemblances may suggest the lines which should be followed, later, in an analytical inquiry.

2. Causes of Resemblance in Handwriting Other Than Inheritance.

Before reporting the present investigation, it will be necessary to consider what causes other than inheritance may account for resemblance between two given handwritings. The following causes may be mentioned: (1) Similar instruction in the art of handwriting, a factor which would increase the chance of resemblance between the penmanship of contemporaries, especially those who have received instruction under the same conditions; (2) preoccupation with the same visual copy, exposure to the same social influences, which would issue, possibly, in similarity between the handwriting of individuals belonging to the same social or professional level; (3) equality in age and writing experience; (4) sameness of sex. To these factors one may add, as a possible cause of resemblance, general similarity in mental constitution, without, however, accepting the ambitious claims of the graphologists.

To put it concretely, apart from kinship, similarity in handwriting may be due to similar instruction, suggestion, age, profession, and sex.

One would expect those persons to write alike who have been under the influence of the same chirographic fashions, who have submitted to the requirements of the same profession, and who are of like age. Among related persons the same expectations would hold. The brother might well write like his brother because of like instruction or like his father because of unconscious imitation, or like his cousin because of similarity in age.

There are at hand studies which show the extent to which such factors as age, sex, mental and moral peculiarities are influential in determining resemblances in handwriting. In France, Binet (3) has put to the test the claims of the graphologists to tell from handwriting the age, sex, ability, and character of the writer. Binet found that even inexpert observers were able to distinguish masculine writing from feminine in at least sixty cases out of a hundred, while expert graphologists sometime reached an accuracy of 80 per cent. It was found that age could be determined by the experts within ten years and that, to a certain extent, intellectual ability could also be determined, but there was very little evidence that character could be ascertained. It was shown also that the ability of the graphologists to tell age, sex, and intellectual ability from handwriting exceeded their power to cite reasons for their judgments. On the whole, however, the signs of sex, age, and ability which had been catalogued by graphologists were found to have a certain validity. On the other hand, how far an appeal should be made to social conditions to explain these signs, how far the appeal should be to physiological or mental causes remains an open question.

These factors that make for resemblance will need to be considered in estimating the results obtained from the experiments to be reported here. It will be found, in fact, that the present investigation contributes somewhat to an understanding of how far character in writing depends upon age and sex. It must be recalled that it is not only in an investigation of inheritance of handwriting that the problem is complicated by the age and sex factor. The same complication is met with in all studies upon inheritance.

The latter statement may be repeated relative to similarity traceable to environmental influences. Perhaps, however, in this connection it is worth while calling attention to a study of invention made by Royce (17), in which he showed a tendency for the inventive mind to vary as widely as possible from the copy set before it. There can be no question that for some individuals "the stimulus of the unlike" operates to accentuate differences between their handwriting and that of their associates either in the home or society.

III. EXPERIMENTAL INVESTIGATION.

In carrying out a test upon family resemblance in handwriting two great difficulties were encountered: (1) that of gathering a sufficient amount of material; (2) that of working out a satisfactory method for the determination of resemblances.

1. *Material.*

The following material was finally chosen as most convenient for use, namely, envelopes addressed to one or two members of the same family by related persons. As far as possible the address was kept constant. This address was, in each case, unless otherwise stated, cut out and pasted upon an oblong of heavy yellow paper. A uniform size was, of course, preserved. The oblongs each carried a number. Several collections of

envelopes were made but only four were utilized in the present test. Each collection will be described in connection with the use to which it was put. An attempt was made to complete each record in both the paternal and maternal lines, but the collections are very incomplete.¹

2. *Method.*

The working out of a satisfactory method for determining resemblance in handwriting brought to light several problems. It would, of course, have been possible to proceed at once to detailed measurements of the slant, size, and formation of particular letters. It seemed better, however, to limit the first investigation to general appearance of the handwriting utilized in the test, detailed description being left for later work. At first sight, it may seem an easy matter to decide whether or not a resemblance exists between two handwritings, but the question arises how far a resemblance reported represents a subjective rather than an objective judgment. To measure degrees of resemblance offered another difficulty.

The method finally selected was one that permitted (1) a determination of the subjective element in judgments on the resemblances between handwritings; (2) an estimation of the varying ability of individuals in determining such resemblance; (3) an approximation of the degrees of resemblance in a series.

This method has been carefully worked out by Wells (20) in his attempt to estimate the varying subjectivity of judgments passed upon different materials. Wells' procedure was as follows: Fifty souvenir postal cards were arranged in the order of preference by ten persons, the average position given to each card being then calculated from the ten arrangements as well as the mean variation from this average position and the mean variation of each person from this average. Five of the ten persons included in the ten made four other arrangements of the same fifty cards, an interval of a week elapsing between each arrangement. The mean variation of each of these five persons from the average of his own arrangements was then calculated and compared with his mean variation from the average of the ten subjects. In this case it was found that the individual's variations from series to series was much less than the individual variation from the general average, thus witnessing the great extent to which a judgment of preference is subjective. Wells shows further that a series of fifty cards and arrangements at week-intervals are sufficient to overcome all error arising from remembrance of a former arrangement. The repetition of the test upon other material, such as colors and weights, completed the test and showed that with the increasing objectivity of the judgment the variation of the individual subject from the general average approximated his variation from his own average.

This method, with a few changes, was applied to part of the material to be considered here. The arrangements were, however, made on the basis of the resemblance of each specimen in a series to a given standard. The series were, moreover, shorter, the longest containing only thirty-eight numbers. The time-intervals between individual arrangements was, occasionally, equal to two or three weeks, although as far as possible an effort was made to keep it constant at one week. It was found that the arrangement of thirty-seven samples of handwriting according to their resemblance to a given standard took much more time than did the arrange-

¹I wish to express my thanks to those who have so kindly aided me in the collection of material. I am particularly indebted to Dr. Grace R. Hebard, Miss Harriet Abbot, Miss Elizabeth Laning, Mrs. J. T. Orr, and Miss Laura Breisch.

I should be very glad to receive material from anyone who will undertake the collection of a series of envelopes, addressed by members of his own family. All relationships, however remote, may be represented and the handwriting of those connected by marriage should be included. The approximate age of each penman should be recorded.

ment of fifty souvenir postal cards according to preference. Such a slow and fatiguing operation was it that where repeated arrangements are not to be made a comparatively short series seems preferable to a long one.

The subject was instructed to arrange the writing specimens in the order of their likeness to a given standard. No explanation was given of the sort of resemblance to be utilized in passing judgment. At the close of each test, the subject recorded, so far as he was able, the basis upon which he had passed his judgment, whether he had given particular attention to slant of writing, size and formation of letters, or limited himself to what he called "the general effect or appearance" of the writing. A record was also kept of the time consumed by each subject on each series.

Some thirty subjects have contributed to the results now to be reported.² Most of these subjects were college women of all grades from Freshman to Graduate. Twelve have done a little work in psychology, but only four of the number have had training in psychological experimentation. In ages, they varied from sixteen to fifty years.

3. *The Subjective Element in Judgments on Handwriting Resemblances.*

In applying Wells' method for determining the subjective element in a particular kind of judgment, two collections of handwriting were utilized, namely, Collection D and Collection A. In the case of each, a standard was chosen and ten subjects arranged each collection in the order of its likeness to the given standard. Five of these ten subjects repeated the test four times, at intervals usually of a week.

(A) COLLECTION D.

This collection was the largest gathered. But not all of the specimens obtained from related members were included in the experimental series because of variation in the form of address. As finally selected it was composed of thirty-eight samples, as follows: 1(F)³, 5(M), 10(M), 15(F), 21(M), 22(M), 25(F), 42(F), 46(F), 48(F), brothers and sisters; 8(F) and 13(F), half-sisters (paternal) to the former; 11(M) and 7(F), father and mother to 1, etc.; 18(F), daughter to 13; 16(F), 36(F), 45(F), paternal aunts to 1, etc., and to 8 and 13; 49(M), paternal uncle to the same; 20(F), 24(F), 41(F), 50(M), paternal cousins to the same; 3(F), maternal grandmother to 1, etc.; 19(M), maternal uncle to the same; 14(F) and 23(M), maternal cousins to the same; 2(M), 6(F), 9(M) and 17(F) constitute another family group unrelated to the former; so also do 30(F) and 35(F); and 32(M) and 44(M). A few duplicates were introduced where variation appeared in the handwriting at different periods; thus 4 is written by the same person as 13, but fifteen years earlier; 26 was written by the same hand as 14, but thirteen years before; 53 was written five years later than 5, but by the same person. As was stated above, the whole collection was not utilized in the test. It includes besides the specimens just listed the handwriting of the paternal grandfather of 1, etc.; six additional paternal cousins; one paternal uncle; and on the mother's side, the handwriting of a great-grandmother, great-uncle, and aunt.

D13 was chosen as standard for comparison.

²I would take this opportunity to thank those who served as subjects in the test, especially Miss Elma Eggleston, Miss Laura Breisch, Miss Leslie Cook, and Miss Marguerite Knopf.

³The letters F and M are used to indicate the sex of the penman.

(B) COLLECTION A.

This collection was composed of thirty-five specimens of handwriting, as follows: 1(F), 4(M), 30(F), brother and sisters; 10(F), their mother; 19(M), their maternal grandfather; 2(M), 11(M), 17(M), 25(F), 28(F), their maternal uncles and aunts; 7(F), 13(F), 22(M), 27(M), 33(F), maternal cousins; 8(F), 9(M), paternal aunt and uncle to 1, etc.; 14(M), 23(F), 26(M), paternal cousins to the same. The other relationships are more remote, as follows: 3(F), paternal half-cousin to 1, etc. (daughter of a half-brother of 1's father); 6(F), 16(F), 20(F), 24(?), 31(F), nieces to 19, and, hence, paternal cousins to 2, 10, etc.; 21(M), nephew to 19 and to 19's wife, hence, double first cousin to 2, 10, etc.; 29(F), 36(F), maternal cousins to 2, 10, etc.; 35(M), maternal uncle to 2, 10, etc.; 5(F), daughter to 6; 32(M), son of 31; 34(F), daughter to 21; 12(F), wife of 9; 18(F), wife of 2.

A19 was chosen as standard for comparison.

TABLE I.

X.				V.		
Results for Ten Subjects—D13.				Average of Table II		
Order	No. of Card	Position	M. V.	Order	Position	M. V.
1	10	2.1	1.34	1	1.44	.19
2	45	6.8	4.32	2	4.08	1.58
3	7	8.4	3.80	3	5.44	3.05
4	53	10.0	7.60	4	7.2	8.07
5	20	10.8	6.56	5	8.04	3.95
6	5	12.3	8.70	6	9.0	4.41
7	24	12.4	6.80	7	9.48	3.44
8	22	13.1	6.50	8	10.24	5.93
9	2	13.3	4.50	9	11.64	4.83
10	4	13.3	6.04	10	12.32	5.92
11	9	14.1	4.50	11	13.16	5.39
12	17	14.2	8.28	12	14.0	6.71
13	35	14.4	3.76	13	14.88	4.81
14	36	14.5	7.0	14	15.72	3.34
15	18	16.0	9.0	15	15.92	4.57
16	21	17.2	6.56	16	17.00	4.92
17	32	17.2	7.6	17	17.72	6.72
18	15	18.5	7.4	18	18.40	5.73
19	23	18.7	8.0	19	19.12	4.67
20	41	19.6	7.6	20	20.00	6.38
21	44	20.2	6.8	21	20.40	4.75
22	16	20.3	6.10	22	21.12	5.21
23	8	20.9	6.28	23	21.80	4.66
24	14	21.1	7.3	24	22.68	3.84
25	42	21.1	8.68	25	23.16	5.08
26	30	21.1	9.1	26	24.04	4.91
27	6	23.0	6.2	27	25.16	3.10
28	48	24	5.8	28	25.52	4.25
29	3	24.3	4.1	29	26.40	4.26
30	26	24.9	4.52	30	27.00	3.68
31	25	25.8	5.04	31	27.60	3.92
32	50	29.9	4.79	32	28.72	3.74
33	46	30.3	3.84	33	30.92	4.00
34	49	31.3	4.16	34	31.44	3.56
35	19	31.5	4.60	35	31.96	3.58
36	11	32.1	3.26	36	33.84	2.57
37	1	34.3	2.24	37	36.24	.61

TABLE II. STANDARD D13.

Order	No. of Card	Dy		No. of Card	Ck		No. of Card	Bt		No. of Card	Wd		No. of Card	Kf	
		Position	M. V.		Position	M. V.		Position	M. V.		Position	M. V.		Position	M. V.
1	10	1	0	45	2.8	.32	10	1	0	10	1.4	.64	10	1	0
2	53	4.4	2.24	2	7.4	2.08	20	4.2	2.72	17	2.0	.40	7	2.4	.48
3	45	4.4	2.64	7	7.4	5.28	18	5.0	1.2	30	5.8	4.88	24	4.6	1.28
4	41	5.2	2.24	10	9.0	3.60	53	6.2	3.12	53	6.8	1.04	30	8.8	5.26
5	4	5.6	1.76	36	10.4	5.28	14	6.4	2.88	18	8.2	4.32	22	9.6	5.52
6	22	6.2	2.16	53	10.6	6.08	17	8.4	3.92	32	8.4	2.08	41	11.4	7.84
7	21	6.6	1.68	14	11.0	2.40	45	8.6	1.68	2	8.6	4.32	45	11.6	7.12
8	24	9.8	2.16	20	12.4	9.68	22	9.8	5.44	45	8.8	3.84	16	11.6	8.56
9	2	9.8	2.56	17	13.8	6.96	15	10	1.6	20	9.2	4.16	53	15.4	8.68
10	36	9.8	4.24	32	14.0	8.40	8	10.8	5.36	42	10.0	2.4	21	17	9.20
11	5	11.4	2.58	35	14.2	6.72	35	11.4	2.72	15	11.8	3.84	23	17	10.8
12	18	12.4	2.88	30	15	11.60	32	12.4	3.68	22	13	2.8	36	17.2	12.6
13	17	13.8	3.84	15	15.2	6.24	42	12.6	4.72	5	14.2	4.96	35	18.6	4.32
14	7	14.6	2.72	16	15.4	2.32	2	14.0	4.00	9	15.8	3.44	32	18.8	4.24
15	6	15.2	2.64	8	16.2	11.44	5	14.4	6.32	44	15.8	6.16	30	18.8	5.36
16	42	17.4	3.92	22	16.8	9.04	7	15.2	4.56	35	16.6	3.92	2	19.0	3.20
17	16	17.8	5.84	21	17.4	6.48	36	17.0	8.40	7	17.2	3.44	14	19.2	9.44
18	3	18.2	4.56	9	18.2	8.22	16	18.0	3.60	25	18.2	6.64	15	19.4	5.68
19	20	18.8	2.96	19	19.4	5.92	24	19.4	2.08	21	18.6	4.88	3	19.4	7.52
20	9	19.4	4.72	26	19.4	13.92	4	21.8	4.96	6	19.0	4.80	26	20.4	3.52
21	15	20.6	3.50	44	19.6	3.92	9	21.8	6.64	36	19.2	4.96	25	20.8	4.96
22	35	20.8	4.56	24	20.6	8.88	3	22.2	5.04	4	21.0	3.6	4	21	4.0
23	8	21.8	3.44	18	21.4	8.08	21	23	3.20	8	21.8	4.16	11	21	4.40
24	30	22.2	3.44	5	23.2	3.04	26	24	2.0	14	21.8	5.36	44	21.2	5.36
25	23	23.4	1.52	6	23.6	6.24	44	24.2	4.64	24	23.2	6.88	9	21.2	6.16
26	48	25	4.4	41	23.8	8.64	23	25	4.40	49	25	3.20	8	21.4	3.92
27	25	26.2	.64	42	24.2	2.24	30	27.4	3.92	3	25.4	3.28	6	22.6	5.44
28	14	27.4	3.12	4	24.2	2.96	6	27.6	4.48	26	25.8	3.04	42	22.6	7.68
29	26	28.4	1.72	25	25.0	6.00	19	27.8	2.16	23	28.2	2.56	5	22.6	8.88
30	44	30	.8	3	25.4	2.88	41	28.2	2.16	48	28.6	3.68	18	22.8	8.24
31	19	30	1.6	48	25.6	4.08	50	29.2	4.11	50	29.2	2.64	50	24.0	7.2
32	46	31.8	1.84	23	26.0	4.4	11	30.2	4.16	16	31.0	2.0	19	24.6	6.32
33	50	33.4	1.68	11	28.6	7.84	1	31.4	2.72	46	33.6	2.32	48	27.6	5.44
34	11	33.4	2.96	46	28.8	3.00	46	31.6	4.48	19	33.8	1.52	46	29.6	5.84
35	32	33.8	.64	50	29.4	4.32	25	31.8	4.32	41	34.6	1.28	49	30.2	7.36
36	1	35	.8	1	33.2	3.68	49	34.0	1.22	11	35.0	.8	1	32	6.4
37	49	37	0	49	34.2	1.84	48	37.0	0	1	36.4	.72	17	36.6	.48

TABLE III.

X.				V.		
Results for 10 Subjects, A10				Average of Table IV.		
Order	No. of Card	Position	M. V.	Order	Position	M. V.
1	2	5.7	3.64	1	3.40	1.92
2	25	6.0	3.80	2	4.68	2.27
3	27	8.5	7.20	3	5.04	3.14
4	10	8.8	5.20	4	5.68	3.17
5	4	9.3	5.42	5	6.48	2.90
6	21	9.8	3.76	6	7.36	3.07
7	22	10.3	6.52	7	7.88	2.92
8	31	10.3	6.66	8	9.04	3.16
9	17	10.5	8.60	9	10.12	3.28
10	20	11.7	5.44	10	10.52	2.83
11	35	12.4	5.54	11	11.08	3.56
12	29	12.9	5.70	12	12.36	4.70
13	11	13.4	7.84	13	14.00	4.94
14	12	15.3	5.62	14	14.64	2.68
15	28	15.5	4.40	15	15.36	3.62
16	9	15.5	7.10	16	15.72	4.20
17	18	15.6	4.60	17	16.32	3.58
18	16	17.5	8.10	18	17.52	3.87
19	26	18.3	9.84	19	18.40	4.12
20	32	19.0	7.40	20	19.12	2.54
21	6	19.3	5.90	21	20.12	2.24
22	24	20.6	3.40	22	20.72	3.44
23	30	22.7	5.50	23	21.68	2.26
24	8	23.5	6.30	24	22.52	3.37
25	14	23.8	5.84	25	24.44	3.28
26	3	23.8	7.40	26	25.28	2.46
27	1	23.9	6.34	27	26.44	3.72
28	36	24.9	4.50	28	27.32	3.82
29	84	25.8	2.84	29	28.08	1.76
30	33	25.8	3.28	30	28.56	1.93
31	23	26.4	4.60	31	29.04	2.56
32	13	27.4	4.64	32	30.64	1.16
33	7	28.2	2.92	33	32.20	.86
34	5	32.6	1.76	34	33.24	.74

TABLE IV. A19 STANDARD.

Order	No. of Card	Dy		No. of Card	En		No. of Card	Ss		No. of Card	Bh		No. of Card	Ja	
		Position	M. V.		Position	M. V.		Position	M. V.		Position	M. V.		Position	M. V.
1	27	1.6	.72	27	1.0	0	2	4.6	3.12	4	8	1.6	20	6.8	4.16
2	22	2.6	.72	31	4.4	.88	25	5.8	2.24	17	8.6	2.72	17	7.0	4.8
3	17	3.6	1.28	22	4.6	1.92	21	6.0	6.4	20	3.8	2.24	29	7.2	3.84
4	21	3.6	1.52	26	4.8	1.44	31	6.2	3.92	10	6.2	3.04	10	7.6	5.92
5	2	5.2	1.84	2	4.8	3.88	29	7.8	4.16	29	6.8	2.16	2	7.8	3.44
6	4	5.8	1.44	20	6.0	2.00	9	8.4	3.12	12	7.8	4.24	32	7.8	4.56
7	11	7.0	1.60	29	6.6	2.32	35	8.6	1.76	28	8.2	4.16	25	9.0	4.80
8	31	9.6	.72	21	7.0	1.60	4	10.2	5.84	31	9.0	2.8	22	9.4	4.88
9	25	9.8	1.44	4	10.8	2.16	20	10.8	6.24	21	9.6	2.88	11	9.6	3.68
10	10	9.8	3.36	14	11.2	1.44	32	11.0	4.00	32	10.2	2.24	12	10.4	3.12
11	29	11	1.60	1	11.8	1.04	10	11.8	5.44	30	10.4	3.28	13	10.4	6.48
12	20	14.2	4.64	10	12.6	2.32	26	13.4	5.44	11	11	5.6	31	10.6	5.52
13	28	14.6	2.32	25	14.2	9.84	22	14.0	5.20	36	16.2	3.36	21	11.0	4.00
14	14	16.2	1.04	30	15	2.40	11	14.8	4.56	27	17.2	1.04	18	11.0	4.40
15	26	17.2	5.84	6	15.2	3.04	28	15.2	4.16	23	17.6	2.72	35	11.4	2.32
16	1	17.8	6.48	13	16.4	1.12	30	15.2	5.36	1	17.8	4.96	9	11.4	3.12
17	6	18.4	3.12	23	16.8	1.76	18	15.8	3.76	24	18.6	4.48	8	12	4.8
18	30	19.6	3.76	16	17.0	3.20	12	16.0	4.0	16	18.8	2.72	4	16.2	5.68
19	13	20.2	6.22	7	17.2	.64	17	17.0	8.0	13	19.4	3.92	6	18.2	1.84
20	24	20.2	1.36	33	18.0	2.0	27	17.4	3.36	34	20.2	4.24	24	19.8	1.76
21	18	20.4	2.32	3	21.8	2.16	6	17.4	3.68	33	20.4	2.16	36	20.6	.68
22	23	21.6	5.52	84	22.0	1.20	36	18.2	3.84	22	21	4.40	30	20.8	2.24
23	16	21.6	3.40	24	22.8	1.04	24	20.2	2.24	7	22.2	3.52	16	21.6	1.12
24	35	22.0	4.40	35	22.8	5.12	16	22.0	2.40	14	22.8	2.16	27	23	2.8
25	32	22.4	4.72	32	23.2	.96	1	26.6	1.76	2	23.6	7.44	34	26.4	1.52
26	12	24.4	3.28	18	24.8	1.04	14	27.0	2.40	26	23.8	3.92	14	26.4	1.68
27	9	27.2	1.82	17	26.0	2.40	23	27.0	3.20	25	24.0	8.40	1	28	2.8
28	33	28.4	2.72	28	28.0	.50	8	27.6	7.28	9	24.4	6.56	7	28.2	1.76
29	7	28.6	1.92	9	29.4	.72	13	28.2	1.76	35	24.8	3.56	23	29.4	.88
30	34	28.6	1.84	36	29.8	1.44	7	29.4	.72	6	25.8	3.76	26	29.4	1.92
31	36	28.6	.72	11	30.2	1.04	3	29.4	6.93	18	27.8	2.16	33	29.4	1.92
32	3	29.2	8.28	8	31.8	.52	33	30.0	.80	5	32	0	13	30.2	1.44
33	8	31.6	2.40	12	33.0	0	34	30.4	1.92	3	33	0	3	33	0
34	5	32.6	2.24	5	34.0	0	5	31.6	1.44	8	34	0	5	34	0

(C). RESULTS.

Table I gives under X the order of resemblance of the thirty-seven cards to D13, obtained by averaging the positions given to each card by ten subjects. The average position and the m.v. from this position are also given. Column V of the same table gives the averaged position and m.v. obtained by a combination of the five records given in Table II. This latter table gives in detail the order for each card assigned by five subjects, the order being determined by averaging the positions given by each subject in five successive arrangements. The average position and m.v. are also given. Tables III and IV give the same data for A19.

A comparison of columns X and V in Tables I and IV will show how far the judgment of resemblance on handwriting is subjective, how far, that is, it is centering around an individual mean rather than around an objective standard, since, theoretically, in repeated judgments of the latter sort, if memory be ruled out, the variations of an individual from his own average should approximate his variation from the average of many individuals.

Table I, D13. It will be seen that the range in X, is from 2.1 to 34.3; in V from 1.44 to 36.24. In X the m.v.'s average 5.92 and range from 1.34 to 9.1. Some of the individual variations are very large; for example, card 17, an extremely variable card, shows one variation that is equal to 22.8. In V, the m.v.'s average 4.14 and range from .19 to 6.72. Some very large variations occur among the individual records. Kf, for instance, gives one equal to 10.8 and Ck one equal to 13.68. The individual range of judgment is not much greater than the range in X; nor is the average variation much smaller.

Table III, A19. This table shows that the range in X is from 5.7 to 32.6; in V from 3.4 to 33.24. The m.v.'s in X average 5.3 and range from 1.76 to 9.84; in V, the m.v.'s average 2.93 and range from .736 to

4.94. Again, although the subjective element is evident, there is no great difference in range nor in the average m.v.

It is clear that the subjective element is present in these judgments upon handwriting, but it is much less evident than Wells found it to be in judgments of preference. Anyone interested may find it profitable to compare his tables with mine. On the other hand, it is also evident that the results can be utilized in an objective way only after careful consideration of each card separately. In certain cases the variations are so great as to make the records of no practical value. Unfortunately, we have no objective scale to which we can appeal to determine the actual value of any particular arrangement, for handwriting resemblance is an uncertain basis for judgment since it may be resolved into many different kinds of similarity. One object of the test was, however, to find out whether the so-called individuality of handwriting could serve as a basis for determination of resemblance. In any case, some very close resemblances were uniformly noticed; the concurrence of judgment with reference to certain cards is very striking. A more complete discussion of Tables I and III will follow in the sections in which the degrees of resemblance noticed and the varying value of the judgments of different individuals are discussed.

The test on the subjectivity of the judgment under consideration was repeated, using D35 and A12 as standards for comparison. Whereas the penman of D13 is related to twenty-one persons in the D collection, D35 is related to only one (D30, sister). A19 is related to twenty-three persons in Collection A; A12 is related to one only (A14, son).

As before, ten subjects arranged the thirty-seven specimens of Collection D in the order of their resemblance to D35. Three (3) of the ten subjects made four other arrangements at intervals of a week or more. The range of positions covered in the average positions given by the ten subjects is for 35 from 6 to 35.6,—a smaller range than was obtained for D13. The m.v.'s average 6.53,—a larger mean variation than was found for D13; the m.v.'s range from 1.28 to 10.1. A comparison of the results for D35 and D13 points to the conclusion that there is some factor in the case of the latter tending to steady the judgment. It seems reasonable to conclude that this factor is the presence of an *objective* resemblance. The average of the repeated judgments for three subjects (Dy, Bt, Wd) when combined give a range of 1.93 to 36.6, and an average m. v. of 3.43 with a range of m.v.'s from .37 to 6.32.

Ten subjects arranged the specimens of Collection A in the order of their likeness to A12, and five of these subjects made four other arrangements at intervals of a week or more. The range of position covered by the averaged positions of the ten subjects is from 7 to 32.4; the m.v.'s average 5.36 and range from 2.6 to 11.16. The repeated arrangements when averaged and combined give a range from 2.08 to 32.88 and an average m.v. of 3.43 with a range from 1.36 to 5.40. A comparison with the results for A19 shows that the subjective element is more noticeable in the arrangements for 12 than in those for 19, a fact pointing again to the presence in the latter case of a more objective resemblance.

The conclusion drawn is that although the subjective factor is present in judgments on handwriting, it is reduced in the case of very strong resemblances. On the whole, handwriting offers an excellent material for the study of such judgments, and the results obtained from it should be compared with those reported by Dearborn (6), in a test in which chance blots of ink were utilized as material.

4. *Varying Ability of Individuals in Determination of Handwriting Resemblances.*

Before discussing the degrees of resemblance revealed by the test, it will be necessary to consider the varying ability of individual subjects to determine resemblance.

Different subjects varied greatly in their method of procedure in the test. Some were exceedingly deliberate and made a careful comparison of details. Others, as Bt, satisfied themselves with a mere glance of the eye. The latter were frequently unable to give a basis for their judgments, which were probably affective in character. Certain subjects would so concentrate upon a particular detail as to lose all awareness of general similarity. They were conscious, too, at times of a shift in the basis upon which judgments were made. Only a few subjects made use of word-concepts, a method frequently utilized by Dearborn's subjects. One (Dy), however, definitely grouped the specimen by the use of such symbolic terms as "Calm," "Cross-Grained," "Querulous" and the like; another utilized such simple categories as "Straight," "Slight slant," "Moderate slant," "Deep slant," and "Back-hand."

Toward the close of a series the judgments became judgments of dissimilarity. The records show that such a judgment is frequently made more easily than is a judgment of likeness. This agrees with Dearborn's report. There were subjects, as Jn, who were more constant in their judgments of dissimilarity than in those of similarity, and who varied less from the average in the case of the latter. Some subjects, Kf, for instance, first selected the specimens most unlike the standard and then proceeded to find the similar hands by elimination of the unlike.

Certain subjects resorted to a rapid sorting of the cards into groups, later determining the relative position in the group by an attempt to "shade" a group into the group that preceded and the one that followed it. Several subjects, as Kf and Jn, showed a tendency to "shade" the series as a whole, that is, to place a card not only by its degree of likeness to the standard, but also by its similarity to the preceding card. This failure to use the standard as the sole point of reference operated to increase variation.

The experiments made it evident that there are certain highly original or unduly artificial hands that are judged by every subject to be unlike every other hand. Yet the use of this hand as a standard frequently showed that it was *less unlike* certain hands than others. A complete record of a collection should, therefore, involve using, one after the other, every hand as a standard. But in the longer collections of the present test such a serial rearrangement of material would have required much more time than could reasonably have been asked of a subject. Again, hands were found that always stood well up in position, as, in a way, similar to every standard used. These hands are simple, conventional hands, with little claim to originality.

An interesting observation made by several subjects during the test was that the feeling of similarity varied greatly from day to day. There were periods when every specimen of writing seemed to resemble every other specimen and other days when every specimen seemed unlike every other. I am inclined to believe that acute introspection would find this shifting feeling of similarity dependent upon variations in organic conditions, as such shifts were especially noticeable on days when the subject was somewhat indisposed or feeling unduly exhilarated. Fatigue also influenced the feeling to a great extent.

But the subjects not only varied greatly in their methods of procedure: they also gave results that varied widely. The value of the judgments of any particular subject may be measured (1), by their variation from the

averages given by the ten subjects; (2) in the case of the repeated judgments, by their variation from the individual's own average. The latter test is of value only if one is assured that memory has not operated to keep the arrangements constant. This latter question will need to be considered in some detail.

The mean variation of the judgments of each individual subject from the judgments of the ten subjects may be obtained by getting the average of his variations from the average position given by the ten subjects for each card in the collection.

The ten subjects for D13 gave the following mean variations from the averages for the ten subjects: Fz, 4.82; Ld, 5.12; Bt, 5.38; Dy, 5.65; Wd, 5.70; Wn, 5.88; Ck, 6.43; Ry, 6.61; Gd, 6.74; Kf, 8.01. The mean variations for D35 were as follows: Ld, 4.98; Gd, 5.35; Fz, 5.38; Bt, 6.54; Wd, 6.62; Wn, 6.84; Dy, 6.92; Ck, 6.93; Ry, 7.39; Kf, 8.32. It will be noticed that the individual m.v. on D35 is in every case but one higher than the m.v. of the same individual on D13. Fz and Ld give results that are closest to the average; Ck, Ry, and Kf results that are most at variance with the average.

Of these ten subjects, Bt, Dy, Wd, Ck, and Kf gave four other arrangements for D13, so that the constancy of their judgments may be determined by their mean variation from their own average. These m.v.'s are as follows: Dy, 2.57; Wd, 3.43; Bt, 3.56; Ck, 5.72; Kf, 5.93 (see Table V). Ck and Kf give the highest variation from their own average; of these five subjects they also give the highest variation from the average of the ten subjects.

Dy, Wd, Bt, who made five arrangements with D35 as standard, gave the following m.v.'s from their average for this series: Dy, 2.66; Bt, 3.43; Wd, 4.12. In this case Dy varies least from her own average, but varies most from the average of the ten.

Turning now to A19, we find the following m.v.'s, for the individual subjects, from the average of all the subjects: Bd, 3.97; Ty, 4.47; Ld, 4.62; Dy, 4.66; Ss, 5.17; Bh, 5.51; Wn, 5.54; Jn, 5.81; Ck, 6.54; En, 7.38. Dy, Ss, Bh, Jn, and En gave repeated judgments with the following m.v.'s on their own average: En, 1.79; Dy, 2.66; Jn, 3.06; Bh, 3.33; Ss, 3.91 (see Table V). The most constant subject (En) is the one who varies most from the average of the ten subjects.

A12 gave m.v.'s as follows, for the ten subjects: Bd, 4.08; Jn, 4.35; Ty, 4.51; Wn, 4.52; Ss, 5.35; Dy, 5.42; Ld, 5.44; En, 5.87; Lc, 6.13; Bh, 6.62. The m.v.'s on an average of five repeated judgments were: Ss, 2.99; Dy, 3.21; En, 3.32; Jn, 3.45; Bh, 4.14; Except for the shift in position of Jn, the order here corresponds to that found in the m. v. from the average of the whole.

Wells in his experiments on judgments of preference found that those subjects who were most constant in their judgments were also most in harmony with the judgments of others. To a certain extent my results point to the same conclusion; thus Kf and Ck, who are the most inconstant of the subjects, varied widely from the average of all the subjects. The most striking exception is En in A19, who gave the very low m.v. of 1.79 from her own average, but the extreme variation of 7.38 from the average of the whole. Constancy in judgment is not in this instance evidence of its representative character.

The Memory Factor. Of the nine subjects who made the rearrangements, only Kf was confident of remembering the positions formerly given to cards. Several recalled the card placed first or last, and were confident that the general grouping remained the same, although the position of cards within the group might be shifted. Only one subject, Dy (the writer), was, before the experiment, familiar with the specimens of handwriting used.

In the D collection she knew the writer of each specimen and his degree of kinship to every other person represented. Her knowledge of Collection A was much less detailed, being limited to a general familiarity with the specimens and a vague—and often inaccurate—memory of the relationships involved. Dy served as subject for several reasons: (1) She wished to determine whether her familiarity with the handwriting and her knowledge of the relationships involved would affect her judgments to any degree; (2) she was anxious to learn in general how far she could trust her own judgment of a resemblance in handwriting as a representative judgment; (3) she wished to obtain an introspective account of the situation. To avoid a possible influencing of her judgment by the judgments of others, tabulation of their judgments was commenced only after Dy had completed the test upon herself.

Dy's introspective record shows that she definitely recalled in the repeated arrangements the cards placed first and last. In general, there was a memory of the order of groups rather than of individual cards. At times, although there had been no recall of the position of a card, after the card was placed the position was recognized as familiar. After the fourth grouping, D13, Dy states: "I am beginning to recall positions. But resemblances are felt to *vary from time to time*. I1 looked today more like I3 than ever before. 6, 9, 17, 36, and 14 looked less similar than before." The main point is that the attitude in a rearrangement was never one of recall; Dy was aware at times of introducing changes; the feeling of resemblance determined the judgment, even when the subject was aware of the change from a previous judgment. The fourth grouping for A19 carries this introspective statement: "I begin to feel my judgments crystallizing, as it were. I have no definite memory of the order, but I am fairly confident of the constancy of the positions of the general groups. I believe my variation will not be great at the end or the beginning, although it may be great in the central range." An inspection of Table V shows, however, that Dy's fourth grouping for A19 was much less accurate than the third grouping. The fourth grouping for A12 bears this statement, "I believe that my grouping today differs very much from that made previously, except for the positions assigned 8, 19, 21, 17, and 27." As a matter of fact, 17 and 27 were placed in a position varying widely from that of the third grouping.

Introspectively, then, there is some evidence, in the rearrangements, of memory of the order of cards, particularly of those placed first and last. On the other hand, there is also awareness at times of a shift in judgment; the remembered judgment is rejected. Again, the introspective reports need discounting, as is shown by the fact that Kf, who was most confident of her judgments being affected by memory, was most inconstant in her judgments, and by the further fact that Dy's definite reports on the position of certain cards in previous groupings is often at fault.

TABLE V.
Comparative Variability of the Individual Series.

Standard	Subject	Series					
		I	II	III	IV	V	Av.
D13	Dy	3.31	2.92	2.25	2.00	2.37	2.57
"	Ok	6.36	5.76	5.68	5.10	5.71	5.72
"	Bt	3.82	3.36	3.76	3.60	3.24	3.56
"	Wd	4.94	2.67	3.88	3.36	2.82	3.43
"	Kf	5.91	5.32	5.80	6.27	6.37	5.93
A19	Dy	4.31	2.14	1.65	2.69	2.40	2.65
"	En	1.90	1.78	1.32	1.98	1.91	1.79
"	Se	5.17	3.84	2.62	4.39	3.52	3.91
"	Bh	4.71	2.97	2.52	3.25	3.24	3.33
"	Jn	3.06	3.36	2.99	2.69	3.16	3.06

Table V gives the mean variability of each series or arrangement from the average of the five. When not stated otherwise, the time interval between the series was one week. Between I and II, Ck(D13), there was an interval of two weeks and between IV and V, Kf(D13) an interval of two months. Between IV and V, Dy(A19) there was a time-lapse of two weeks; between I and II, En(A19), two weeks, and between IV and V, three weeks; there was a lapse of two weeks each between I and II and between III and IV for Bh(A19).

I cannot see that these irregularities in the time-interval have affected the results in any particular way, as they probably would, had memory entered to any degree.

From the table it appears that the first series varies most widely from the average except for Kf, En, and Jn, and this fact gives some justification to the idea that memory has been influential in the rearrangements. But there is no approximation to the average, series by series, as one would anticipate if this were true. The most accurate series for Dy is the fourth; for Ck, the fourth; for Bt, the fifth; for Wd, the second; for Kf, the second; for Dy(A19), the third; for En, Ss, and Bh, the third; for Jn, the fourth.

Apparently memory has not affected the results seriously. There is, however, some reason to believe that familiarity with the writing under consideration is favorable to the perception of likeness and difference.

The first and last members of the series should show most evidently the effect of memory, if operative. Tables VI and VII give the combined variations for each set of five consecutive positions for D13, D35, A19, and A12, obtained from the average for five arrangements by each of five subjects; it gives also the average for the five subjects in the repeated arrangements and the average for ten subjects, one arrangement each.

TABLE VI.
Av. M.V. for each Set of Five Consecutive Variations

Standard	Subject	Positions.							
		1-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
D13	Dy	1.77	2.56	2.99	4.40	3.28	2.13	1.74	1.21
D35	"	1.10	2.94	2.97	2.71	4.27	3.86	2.08	1.28
D13	Ck	3.31	6.70	7.66	8.72	6.08	4.54	4.72	4.13
D13	Bt	1.98	3.60	4.28	4.73	4.30	3.42	3.95	2.54
D35	"	2.05	3.84	3.88	4.19	4.32	5.39	1.81	1.47
D13	Wd	2.25	3.36	4.30	4.73	4.99	3.15	1.95	1.32
D35	"	2.24	4.06	5.64	4.54	4.96	3.38	4.96	2.96
D13	Kf	2.52	3.32	7.46	5.87	4.97	6.83	6.43	5.10
D13	Av.	2.36	4.91	5.33	5.68	4.71	4.01	3.75	2.36
D35	Av.	1.79	3.62	4.16	3.81	4.52	4.04	2.91	1.87
D13	Av. for 10	4.72	6.58	6.50	7.43	7.03	5.94	4.48	3.62
D35	Av. for 10	5.04	7.48	7.14	8.01	6.82	5.99	6.08	5.13

TABLE VII.
Av. M.V. for each Set of Five Consecutive Variations.

Average	Standard	Positions						
		1-5	5-10	10-15	15-20	20-25	25-30	29-34
A19	Dy	1.21	1.71	3.08	4.18	4.07	2.31	2.09
A12	"	2.08	5.18	4.94	3.48	3.48	1.86	1.05
A19	En	1.52	1.90	3.73	1.74	2.09	1.28	.56
A12	"	.93	1.74	3.58	5.88	5.01	2.76	3.48
A19	Ss	3.96	4.19	4.96	4.89	2.78	3.07	2.36
A12	"	2.24	3.58	3.66	3.50	3.33	2.25	2.52
A19	Bh	2.35	3.26	3.20	4.06	3.98	5.24	1.18
A12	"	2.08	4.97	4.64	5.29	4.56	5.17	2.68
A19	Jn	4.43	4.21	4.54	3.44	1.71	1.81	1.05
A12	"	4.52	4.52	3.18	6.70	3.05	1.56	.62
A19	Av.	2.69	3.05	3.90	3.66	2.91	2.74	1.44
A12	Av.	2.37	3.98	4.00	4.97	3.88	2.72	2.07
A19	Av. for 10	5.05	6.19	5.82	6.41	5.38	4.87	3.44
A12	Av. for 10	4.71	5.05	6.23	8.44	5.41	3.09	4.11

It is evident that the variations are, on the whole, greater in the middle range than for the first and last positions. In the case of the repeated judgments, this is exactly what we should expect from the operation of memory. It is just as evident, however, in the case of the variations for the ten subjects (except in A19), where there were no repeated judgments. The introspective records show that it is much more difficult to place cards in the middle range than in the earlier and later positions, so that this fact accounts for the greater uniformity in respect to these positions as plausibly as does the assumption that there is a remembrance of the cards placed first and last. It is, however, certain that two or three subjects, at least, definitely recalled the cards that had in a previous grouping been placed first or last, but this memory was in every case checked by a new judgment of likeness.

Tables VI and VII show that the judgment of unlikeness is, on the whole, an easier one to make than the judgment of likeness. There is considerable agreement among subjects as to the handwriting most unlike a given specimen. Some individual differences in this respect come out to a striking degree. Most noticeable is the case of Jn, whose judgments of difference were uniform, but whose judgments of likeness were very inconstant. No doubt we have here an individual trait of some importance.

The following facts with reference to the subjects may be emphasized in a summary. The subjects showed considerable difference in their ability to pass judgments on similarity in handwriting, a fact which, of course, might have been anticipated. Kf and Ck varied most widely from the average of the ten subjects and from their own average. They were the poorest subjects found. En, who is very constant in her judgments, varied in one instance widely from the average. Jn, who perceives differences readily, is much slower in a perception of likeness. Bt, Wd, Dy, Ss, and Bh gave average results. Bt passed her judgments so rapidly as to be a valuable subject for this reason alone; Bh was exceedingly deliberate. Dy's knowledge of relationships probably influenced her somewhat in passing her judgments but, if so, in such a way as to bring them into greater harmony with those of the average, a result which can be explained only

on the supposition that a resemblance actually exists between the handwriting of certain relatives.

5. *Degrees of Resemblance.*

In discussing the resemblances in handwriting brought out by the test, Collections H and L, will be utilized as well as Collections D and A.

(A) COLLECTION D.

The discussion of the resemblances found in this collection, which has already been described, will be based mainly upon the arrangements made when D13 was used as the standard for comparison. A complete study would involve, as stated before, the use in turn of each specimen in the collection as the standard.

The most remarkable resemblance found under the conditions of the test is the resemblance between 13 and 10. (See Plate II, a.) A reference to Table I shows that 10 received 2.1 when the positions given it by ten subjects were averaged. The actual positions given were as follows: 1, 1, 1, 1, 1, 2, 4, 4, 5. Each of the five subjects who repeated the arrangements placed 10 first in their first grouping; three of them made no change in its position in the other four arrangements; Wd in her third arrangement shifted it to the third position, but restored it to the first place in the fifth grouping; Ck, one of the most unreliable subjects, gave the most variable judgments on 10, with a final order of 4 on an average position of 9 (m.v., 3.6). That the resemblance between 10 and 13 is a much closer one than that existing between 13 and any other specimen is shown by the distinct isolation of 10 in the table that gives the average positions. The same distinct break occurs in the records of Dy, Bt, and, in a lesser degree, in the record of Kf.

The relationship represented is that of a paternal half-brother. The resemblance is a significant one, since it cannot be attributed to a similarity in educational and social environment. 13 is more than twenty years older than 10, and left the home when 10 was a little child. The education of 13 and 10 was very different.

45 (Plate II, a) takes second place in resemblance to 13 on the following positions: 1, 1, 3, 4, 5, 6, 6, 11, 20 (av., 6.8, m.v., 4.32). In the repeated arrangements, it takes first place for Ck, third for Dy, seventh for Bt and Kf, and eighth for Wd. There can be no question that a resemblance exists between 13 and 45, although a less noticeable resemblance than that found for 13 and 10. 45 is a paternal aunt of 13 and more than twenty years older. As before, the educational and social environment of the two has been very different.

The card (7) receiving the third position is again separated from the preceding one by a distinct break. (Plate II, b.) The positions given it were 2, 4, 5, 6, 6, 9, 10, 11, 14, 17 (av., 8.4, m.v., 3.8). On the repeated arrangements, it takes second place with Kf, third with Ck, fourteenth with Dy, sixteenth with Bt, seventeenth with Wd. It should be recalled that Ck and Kf are less reliable judges than the other three. It is interesting to note also that Bt, Dy and Wd place 7 at a greater distance from 13 in the rearrangements than they did in first trial. 7 is no relation to 13 or 45, but is the mother of 10.

The fourth position goes to 53 (av., 10, m.v., 7.6). (Plate II, a.) The very high m.v. is due to the great divergence in judgment of Kf, who places 53 in the thirty-first position. In the repeated judgments Kf alters her judgment, placing 53 in turn in the thirteenth, ninth, twenty-second, and second position, a statement which shows how little reliance can be given

to Kf's judgment. In the repeated judgments, 53 takes second position in Dy's average, fourth in Bt's and Wd's, sixth in Ck's, and ninth in Kf's. As six of the ten subjects placed 53 before 7, it probably represents a greater resemblance than does 7. 53 is half-brother of 13, brother of 10, nephew to 45, son of 7.

20 (fifth position) is paternal cousin of 13, 10, and 53, and daughter of 45. The high m.v. was caused by the divergent judgment of Ck. (Plate II, b.)

5 (sixth position) was written by the same person as 53, but five years earlier. That 53 and 5 should be ranked so nearly together witnesses the general value of the grouping. The change in 5's style of writing during the five years will be mentioned later. The high variation again is due to Kf's divergence in judgment. (Plate II, b.)

24 (seventh position) is a paternal cousin to 13, 10, 53, 20 and niece of 45. (Plate II, b.)

22 (eighth position) is half-brother to 13, brother to 10 and 53, cousin to 20 and 24, nephew to 45, son to 7.

2 (ninth position) is no relation to any of the above.

4 (tenth position) was written by the same person as 13, fifteen years before. It is a much more conventional hand than 13. Two subjects placed it second in likeness to 13.

It does not seem worth while discussing the degrees of resemblance beyond the tenth position, so great were the individual variations within the middle range. Any one who is interested may consult Tables I and II for the complete record. A further table was prepared for the first ten cards, in which an average was obtained from the six mean positions, the two highest and the two lowest judgments being rejected. This table is not given, as the only shift in position that results from such a treatment of the judgments is the placing of 53 before 7, a change suggested for other reasons. Such a table shows a considerable lowering of the average position and a great reduction in the m.v.

A cut giving the standard and the specimens arranged within seven places will enable everyone to estimate for himself the extent of the resemblances. (See Plate II, a and b.)

(13) Mrs. S. W. Downey
Laramie
Wyoming.

(10) Mrs S. W. Downey
Laramie
Wyoming

(45) Miss June E. Downey
Laramie City
Wyoming

(53) Miss June E. Downey
Laramie,
Wyoming.

(7) Miss Norma Downey
Laramie
Wyoming

(20) Miss June Downey.
Laramie City
Wyoming

(5) J E Downey.
Laramie
Wyoming.

(24) Mrs. Steven Downey
Laramie
Wyoming

Mrs. E. V. Downey,
Laramie,
Wyoming.

Mrs S. W. Downey
Laramie
Wyoming

PLATE III.

Plate III gives an additional illustration to show the essential similarity between the hands of 10 and 53. These two are brothers, very slightly different in age. 53 is the better penman of the two. At one time, about six years ago, he took lessons in commercial penmanship, lessons which resulted in an improved but conventionalized hand (See No. 5). With the lapse of time he is returning to his old hand,—a fact which shows how deep-seated the natural tendencies are.

Although it does not seem worth while discussing the arrangement of cards in the middle range, the extreme dissimilarities are very significant.

The tables show that 1, 11, 19, 49, 46, and 50 are distinctly unlike 13. No. 19 is not related to 13, but the others include the father, half-sisters, paternal uncle, and paternal cousin of 13.

I was so uniformly grouped by itself as an individual hand that it seemed desirable to obtain a number of arrangements in which it should be used as the standard for comparison. Eight arrangements were obtained, one each from Bt, Dy, Wd, Kf, Ck, Ld, Gh, Fz. The results confirm the declarations of the subjects that it is very difficult to use this hand as a standard. Twenty of the cards, for instance, were given an average position between 16 and 20. One very evident resemblance was, however, determined, a resemblance to 46 (sister). This card was ranked as follows: 1, 1, 1, 1, 2, 2, 7, 17(Ck). 14 (maternal cousin) also shows a resemblance and receives second position, but it is separated from 46 by a distinct break. The other positions seem not worth discussing, so closely are they massed. It is, however, significant that 3 (maternal grandmother), which held twenty-ninth position in the grouping for 13, has now been advanced to the eighth place. Plate IV gives cuts of 1, 46, and 14.

Miss June E. Downey,
 (11) University of Wyoming,
 Laramie
 Wyoming.

(46)

Miss June E. Downey
 Laramie
 Wyo.

(14)

Miss June E. Downey
 Laramie,
 Wyo

The specimens found to be most unlike 1 were 50, 19, 30, and 11.

Six arrangements were made with 11 as standard, one each by Wd, Dy, Bt, Ck, Ld, and Gh. As was found true in the case of 1, so here there is a massing of results. One resemblance comes out definitely; 8 (a daughter) takes first place.

Eight specimens were introduced into the collection, the writers of which were related to none of the family group under consideration. One of these, 35, was used as a standard of comparison in a series that included arrangements by 10 different subjects and repeated arrangements by three of these subjects. It has already been shown that the subjective factor is shown to be greater in such a series than in the one in which D13 was used as standard, and that, too, although D35 is not a highly individual hand. One specimen (30) was written by a related person, a sister. 30 stands tenth in the table of averaged positions for 35, whereas in Table I it stands twenty-sixth. A slight resemblance exists between 30 and 35. No card resembles 35 as 10 did 13, the first position going to 2 (a writing that is found to resemble many others) on an average of 6 (m.v., 3.8). The next two cards both receive an average position of 10.5.

2, 6, 9, and 17 constitute another family group, consisting of mother (6), daughter (17) and two sons (9 and 2). Both 9 and 2 resemble many other hands; 17, who is left-handed, has been taught to write with her right. Table I shows some tendency of subjects to group these specimens together. The positions received were ninth for 2, eleventh for 9, twelfth for 17; 6, however, occupies the twenty-seventh position. With 17 as standard, eight arrangements were made: 2 took second place on the averaged positions; 9 took the tenth position; 6, the twelfth position.

32 and 44 were father and son. The son writes an unformed hand, the father a highly finished one. The character of the two hands is similar. They hold in Table I the seventeenth and twenty-first places.

From a study of the results of the test, the following conclusions are drawn relative to the character of the handwriting of the ten brothers and sisters around whom the collection centers. Two of the brothers (10 and 53) write very similar hands, a hand that, in turn, is very like that of several relatives on the paternal side. The writing of a third brother (22) also resembles the same general type. The hand of the fourth brother (21) was not placed by the test. It takes sixteenth place in the table of averages and seventh, tenth, seventeenth, nineteenth, and twenty-third place in the repeated series, so that no conclusion is warranted.

The handwriting of at least two of the sisters (1 and 46) is very unlike the paternal hand; there is reason to believe that this writing resembles that of maternal relatives. Of the other sisters, 48 is an unformed hand and 42 an unpracticed one, neither of which can be placed.

There is good reason for grouping the writing of two other sisters (15 and 25) with 1 and 46. It will be noticed that 25 and 26 are contiguous in Table I. 26 is written by a maternal cousin, the same as the penman of 14; an interval of twelve years separates the two writings. At the time of writing the earlier specimen the cousin was near the age of 25. That there exists a close resemblance between the writing of these two cousins has frequently been noticed in the family.

The stages that mark the development of the handwriting of the penmen of 1, 14, and 15 are interesting. In each case there have been striking shifts in the character of the hand; the handwriting of none of them "formed" early. A series of specimens obtained at intervals of some years shows that the writing of 15 has at different periods resembled that of 1 (the elder of the two) at the same period, although there is very little resemblance between their hands at the present time. The present hand-

writing of 15 resembles 14. The two latter hands are more conventional and formal today than they were at an earlier period.

A tendency toward backhand writing is pronounced in the writing of 1, 46, 15 (at an early period), and 14. This tendency in the case of all except 1 may be due to the fact that they were taught vertical writing. The tendency, however, does not appear in the writing of 10 and 53 (brothers), who had similar instruction.

The handwriting of 48, the youngest of the ten, is, apparently, quite different from that of the others. Although it is not yet formed, it does not show the tendencies noticeable in the other hands during the formative period. None of ten brothers and sisters, with the exception of 53, would be called a fluent or good penman. 53's hand was "formed" at an early period. He is strongly motor in type.

Although the handwriting of these brothers and sisters may be grouped in the manner suggested, it is difficult to place the handwriting of their parents. The father's hand is a very individual one, and one which his children greatly admired. It is not, however, repeated except, to a slight degree, in the writing of one daughter, half-sister to the ten. The mother's writing (Plate II, b. 7) was grouped with the writing of her sons and their relatives on the paternal side. No reason for this can be given, although a similar thing has been noticed in the physical likenesses in the family, in that the children who are said most to resemble the mother are also thought to be most like the father's family.

(B) COLLECTION A.

This collection has already been described. The discussion of the resemblances it shows will be based upon the arrangements made with A19 as standard for comparison. (See Plate V, a.) No resemblance as striking as that between D13 and D10 was found, but the grouping within ten places was, on the whole, more satisfactory than in the preceding case. Table III, X, gives the average results for the ten subjects, one arrangement each.

27 was placed first three times; 17, first, twice; 2, 22, 25, 11, 10, first, once each. In Table III, 2 holds the first place with a position of 5.7 (m.v. 3.64), averaged from 1, 2, 2, 2, 4, 5, 6, 10, 11, 14. In the repeated arrangements, 2 is placed first by Ss, fifth by Dy, En, and Jn, and twenty-fifth by Bh, although in her first judgment Bh placed it fifth. 2 is a son of 19, naturally left-handed, but trained to use his right in writing. (Plate V, a.)

25 holds second place in the table (position 6, m.v. 3.8), separated from 2 by a narrow margin on the following positions: 1, 3, 3, 3, 3, 4, 7, 7, 10, 19. In the repeated arrangements it is placed second by Ss, seventh by Jn, ninth by Dy, thirteenth by En, twenty-seventh by Bh, who, however, placed it third in her first arrangement. 25 is a daughter of 19 and a sister of 2. (Plate V, a.)

The third place went to 27 (position 8.5, m.v. 7.2). In the repeated arrangements, it takes first place for Dy and En, but stands far down in the table for the other three subjects, Ss departing widely from his first judgment on it (first place) in the subsequent arrangements. 27 is grandson to 19, nephew to 2, son to 25. (Plate V, a.)

10 takes fourth place (position 8.8, m.v. 5.20). It is separated from 27 by a very narrow margin, while the m.v. is smaller. In the repeated arrangements, it receives the fourth place for Bh and Jn, tenth for Dy, eleventh for Ss, twelfth for En. 10 is daughter to 19, sister to 2 and 25, aunt to 27. (Plate V, b.)

The fifth place belongs to 4 (position 9.3, m.v. 5.42.) In the repeated arrangements, it is placed first by Bh, sixth by Dy, eighth by Ss, ninth by En, eighteenth by Jn. 4 is a grandson of 19, son to 10, nephew to 2 and

25, first cousin to 27. The close resemblance of 4 to 19 may be inferred from the fact that a schoolmate of 4's, seeing specimen 19, stated confidently that it was written by 4. (Plate V, b.)

21 takes the sixth place (position 9.8, m.v. 3.76). In the repeated arrangements 21 is third for Ss, fourth for Dy, eighth for En, ninth for Bh, thirteenth for Jn. 21 is nephew to 19 and a DOUBLE first cousin to 2, 25, 10. (Plate V, b.)

The seventh place is held by 22 (position 10.3, m.v. 6.52). 22 is second for Dy in the repeated judgments, third for En, eighth for Jn, thirteenth for Ss, twenty-second for Bh. 22 is grandson to 19, son of 25, nephew to 2 and 10, brother to 27, cousin to 4. (Plate V, b.)

31 takes the eighth position (position 10.3, m.v. 6.66). In the repeated judgments, 31 is second for En, fourth for Ss, eighth for Dy and Bh, twelfth for Jn. 31 is niece to 19, first cousin to 2, 25, 10, and 21.

The ninth position is held by 17 (10.5, m.v. 8.60). The variation on this card is very high. In the repeated arrangements, it is second for Bh and Jn, third for Dy, nineteenth for Ss, and twenty-seventh for En. 17 is son to 19, brother of 2, 25, 10, uncle to 27, 4, and 22, first cousin to 21 and 31. (Plate V, c.)

20 holds the tenth position (11.7, m.v. 5.44). In the repeated arrangements 20 is first for Jn, third for Bh, sixth for En, ninth for Ss, twelfth for Dy. 20 is niece to 19, cousin to 2, 25, 10, and 21.

As before, it does not seem worth while discussing the cards that fall below the tenth position in the table of averages. It is interesting to note that none of the eleven persons who were unrelated to 19 appear in this table within the first ten places.

While, as it was stated before, there is no one resemblance to A19 as uniformly perceived as was the resemblance of D10 to D13, the ten cards chosen as most like 19 are, as a whole, more like it than the ten cards chosen for D13. To a certain extent, the resemblance to 19 on the part of many cards introduced variation in the judgments. Thus, the specimens placed in the first ten positions by Dy on the average of the repeated arrangements are, with one exception, just those that hold the first ten positions in Table III, but in a very different order. If one uses the table in which the four extreme judgments have been thrown out, the ten correspond exactly. A19 is a more individual hand than D13. It is the hand of a very old man (eighty-four years). It is evident that different observers noticed different points concerning it. Thus, on the one hand, there is a resemblance to 22 and 27 (grandsons) and, on the other hand, a different resemblance to 2 and 21 (son and nephew), and a yet different one to 25, 10, and 4 (daughters and grandson).

The resemblances given above include resemblances between a father (19), two sons and two daughters, three grandsons, and two nieces. There was also included in the collection the writing of one other son and daughter, five granddaughters, three nieces, two grandnieces and one grandnephew.

Table III shows that 11 (son) and 28 (daughter) occupied respectively the thirteenth and fifteenth places. The variation on 11 is very great. One observer gave it first place in the likeness to 19; in the repeated judgments Dy and Jn place within the first ten; and in the table of averages from the six mean positions, the four extreme judgments being thrown out, it occupies the tenth position. Its general character is very similar to the other specimens of this family group. (See Plate V, c.) 28 is a much less individual hand than that of the other brothers and sisters. One cannot claim a distinct resemblance to 19, but one would certainly group it with 25 and 10. (See Plate V, c.)

(19)

Mrs J. H. Abbot
 Laramie Wyo
 602-7th South St

(2) Mrs J. H. Abbot
 602 So. 7th St
 Laramie W

(25)

Mrs J. H. Abbot.
 602 S. 7th Laramie
 Wyo.

(27) Mrs J. H. Abbott.
 602 S. 7th St.
 Laramie,
 Wyo.

(10) Miss. Anna G. Abbot
 Osceola
 Co Nebraska

Miss Anna Abbot
 (4) Osceola
 Neb.

(21)
 Mrs. Jennie L. Abbot.
 Laramie
 to 10 7th St Wyo

(22)
 Mrs. J. H. Abbott.
 602 S. 2nd St.
 Laramie,
 Wyo.

Mrs J. H. Abbot.
 (17) #602 So 7th street
 Laramie
 Wyo

(11.) Mrs J. H. Abbot.
 Laramie
 South 7th St Wyoming

(28) Mrs J. H. Abbot.
 602 So 7th St.
 Laramie,
 Wyoming.

PLATE V, c.

That the writing of the six sons and daughters of 19 should show such a resemblance is striking, as is also the subgrouping of the writing into (1) those of the brothers (2, 17, 11), and (2) those of the sisters (25, 10, 28). The general effect of these two groups is very different, due partly to the great difference in pressure, but there is something similar in the texture of the writing as well as in the formation of letters. We find this hand repeated again in the writing of three paternal cousins, with again, a noticeable difference between the masculine and the feminine hand.

The only specimens of the writing on the maternal side found in the collection is that of 35 (maternal uncle), 29 and 36 (maternal cousins) and

21 (maternal and paternal cousin). 21 has already been discussed. 35 and 29 hold the eleventh and twelfth places in Table III. They are certainly not strongly dissimilar to some of the hands preceding them; they resemble the handwriting of the daughters rather than that of the sons.

The handwriting of three grandsons was found to resemble that of 19. Although specimens of the writing of five granddaughters (1, 7, 13, 30, 33) were included in the collection, not one of these found its way into the group centering around 19. 1, 7, 13, and 33 show strongly the effect of instruction in vertical handwriting, with a strong tendency to backhand in 1, 13, and 33. 7 and 33 are too stereotyped to be individual; 1 and 13 are more individual and very similar. It is noticeable how much more conventional are 13 and 1 than 27 and 4, the writing of younger brothers. The test did not place 30, which is a rounded hand, slightly resembling 10 (mother).

Collection A centered around the writing of 1, 4, and 30. It has already been noticed that 4 resembles 10 (mother) and 19 (grandfather). 1 resembles 13 (maternal cousin); 30 is not placed.

Six paternal relatives of 1, 4, and 30 contributed specimens to the collection: 9 (uncle), 8 (aunt), 3, 14, 23 and 26 (paternal cousins). 14 and 23 (unformed hands) show instruction in vertical writing and are grouped with 1, 7, and 13. 3, 23, and 26 show a tendency to backhand which is pronounced in 3. There are, however, no strong resemblances. 3 and 8 were very individual hands and fall well toward the close of every arrangement.

The most unusual hand of the whole collection is 5, which stands thirty-fourth in Table III and occupies the same position in the repeated arrangements in every case except that of Bh, who places it in the thirty-second place with 3 and 8 in the closing positions. 5 is a highly artificial hand.

A series of judgments was obtained with 12 as standard for comparison. 12 is related to 14 (son), but to no one else represented in the collection. With 12 as standard, the subjective element was more pronounced than when A19 was standard. 11 took first place on a position of 7.2 (m.v. 5.58). It is noticeable that 11 is thirteenth in Table III, with 12 occupying the next position. On the whole, the first and second half of Table III correspond pretty well with the halves of the table that gives the record of average positions for 12. 14 shows no resemblance to 12, occupying the twenty-sixth position. It is, however, an unformed hand, while 12 is a highly finished one. It is worth noticing that two of the subjects in arranging for 12 definitely adopted fluency of writing as the basis for the arrangement.

(C) COLLECTION H.

This collection was a miscellaneous one, containing five groups. No selection of material was made; the envelopes used, with three exceptions, were taken at random from the correspondence of H. 4, 8, and 10 were obtained by request, and did not pass through the mails. There were fifteen numbers in the series.

The groups were composed as follows: First Group, 1(F), 5(M), 7(M), 10(F), brothers and sisters; Second Group, mother (13) and two daughters (6, 9); Third Group, father (12) and son (3); Fourth Group, father (11), mother (4), son (2), and daughter (8); Fifth Group, father (15) and daughter (14).

It will be seen that the collection contains the handwriting of eight women and seven men. Of the women 1, 8, 10, and 14 are teachers; 5(M) is a lawyer; 7 and 15 are business men; 11 and 12 are bookkeepers; 2 is a college instructor. All but 3, a boy of seventeen, are adults. 13 and 15 are elderly persons.

Fifteen different arrangements of the collection were made by each of ten subjects. One specimen from each group was first chosen as standard; some few weeks later each of the remaining specimens was used as standard. In the second test three new subjects took the place of three of the first ten, from whom it was impossible to obtain the second series of judgments. The subjects were not familiar with the hand-writing that appeared in the collection.

RESULTS.

The results for the first group, composed of 1(F), 5(M), 7(M), and 10(F), are given in Table VIII.

TABLE VIII.

No.	Standard 1			Standard 5			Standard 7			Standard 10		
	Order	Position	M. V.	Order	Position	M. V.	Order	Position	M. V.	Order	Position	M. V.
1				10	8.3	2.70	8	7.7	3.64	13	11.0	2.0
5	14	10.6	2.68				12	9.3	3.50	2	3.9	2.68
7	3	4.8	1.68	7	7.1	2.34				7	6.6	3.04
10	12	10.2	1.64	3	4.2	2.48	14	10.5	2.8			

From the table it appears that 7 shows some resemblance to 1, 10 to 5 and 5 to 10, the closest resemblance found being that of 5 to 10. 1 and 5 and 1 and 10 are highly dissimilar, as, in a slightly less degree, are 7 and 5 and 7 and 10. (See Plate VI.)

Each pair will need to be considered separately. From the average position obtained by 1 and 7 in the series as a whole, it appears that 1 is a more individual hand than 7. 7 resembles many hands in the series, as shown by the fact that when used as the standard for comparison there is a small range of positions and high mean variations. 1 received eighth place. With 1 as standard, 7 takes third place. This pair shows, then, a resemblance, but not a striking one.

The resemblance between 5 and 10 is more noticeable. With 5 as standard, 10 took third position, averaged from the following positions: 1, 1, 2, 2, 3, 4, 4, 5, 6, 14. The average is unduly affected by the 14. In fact, 10 was selected before the card taking second place six out of ten times. 11, which took first position, was chosen before 10 six times. With 10 as standard, 5 took second place with an average position of 3.9. The same position was received by 14 with a slightly lower variation, which gives it the first position. Actually, however, 5 was chosen before 14 six out of ten times and probably, therefore, deserves the first position.

The relationship for 5 and 10 and for 1 and 7 is brother-sister. Of the four 5 and 1 are the older; 10 and 7, the younger. No two of the four had the same teachers. If companionship produces similarity in handwriting the likeness should be found between that of 1 and 5, and 7 and 10. It is an interesting fact in this connection that there is a great physical resemblance between 5 and 10 and between 1 and 7, and dissimilarity between 1 and 10, 5 and 7, etc.

An inspection of the cut (Plate VI) will show the kind of resemblance that exists between the handwriting of the two pairs.

Dr. G. R. Hebard.
(1) Laramie,
Wyo.

(7)
Mr. Grace Hebard
Laramie
Wyoming

Miss Grace R. Hebard
(5) Laramie
Wyoming

(10)
Miss Grace Raymond Hebard
Con. of University
Laramie
Wyoming.

The results for the second group, composed of 13(F), 6(F), and 9(F) are given in Table IX:

TABLE IX.

No.	Standard 6			Standard 9			Standard 13		
	Order	Position	M. V.	Order	Position	M. V.	Order	Position	M. V.
6				2	3.4	1.6	6	7.0	3.80
9	1	4.4	2.68				8	7.9	3.72
13	9	8.4	2.68	11	9.4	2.4			

There is no evidence of a resemblance between 13 and either 6 or 9, although it is less unlike 6 than 9. 6 and 9 show a resemblance.

The relationship between 6 and 9 is that of sisters. The resemblance in their handwritings appears to be found in the formation of letters. The texture of the writing is very different in the two cases.

(6)
Dr. Grace R. Hebard
University of Wyoming,
Laramie,
Wyoming.

(9)

Dr. Grace R. Hebard,
Laramie,
Wyoming.

PLATE VII.

The third group was composed of 3(M) and 12(M). 12 is a very individual hand, written by a man of much experience. In the fifteen different arrangements it was placed in the last position six times. 3 is a more colorless hand, or, rather, a more immature hand, written by a boy of seventeen. At first glance the resemblance between these two hands

is evident. In the test when 12 is used as standard, 3 receives the second place on the following positions, 1, 1, 1, 1, 2, 3, 4, 5, 6, 7; average, 3.1 (m.v. 1.92). The number receiving the first place did so on the same average, 3.1, but with a mean variation of 1.3. When 3 was used as standard, the average position assigned 12 gave it seventh place. This average position was 6.5, with a mean variation of 5.2. This high mean variation shows the presence of some disturbing factor. The following positions were given 12: 1, 1, 1, 3, 3, 4, 12, 12, 14, 14. The conclusion drawn is that 3 resembles 12, but that this resemblance is masked by the immaturity of 3. The relationship is that of father and son.

(12)
Miss Grace R. Hebard
Secretary
Laramie Wyo

(3)
Miss Grace Raymond Hebard
Laramie,
Wyo
% V. of W.

PLATE VIII.

The fourth group was composed of 11(M), 4(F), 2(M), and 8(F). 11 was a very experienced hand; 4, an unaccustomed hand. Table X below summarizes the results:

TABLE X.

No.	Standard 2			Standard 4			Standard 8			Standard 11		
	Order	Position	M. V.	Order	Position	M. V.	Order	Position	M. V.	Order	Position	M. V.
2				6	6.9	2.92	1	4.7	2.56	9	8.8	4.04
4	13	10.8	2.48				5	6.2	2.48	8	7.6	3.0
8	3	6.3	3.04	2	6.0	3.8				11	9.2	1.60
11	9	8.7	3.02	12	8.6	3.2	14	11.0	1.6			

There is evidence of a resemblance between 2 and 8 and of a slight resemblance between 4 and 8. 11 shows no resemblance to the others. How far the results should be accepted as showing a likeness between 4 and 8 is doubtful. Although 8 receives second place when 4 is used as the standard, the range of positions is so small (seven of them lie between 6.0 and 7.0) that the result is of little value.

2 and 8 are brother and sister; the age-difference is slight.

The fifth group consists of 14(F) and 15(M). When 14 was used as standard, 15 received second place, with an average position of 5.6 (m.v. 3.42); with 15 as standard, 14 received sixth place on an average position of 6.7 (m.v. 2.5). There is some evidence of a resemblance. The relationship is that of father and daughter.

(14) Miss Grace Raymond Hebard,
University of Wyoming,
Laramie,
Wyoming.

(15) Miss Grace R. Hebard,
University of Wyoming,
Laramie,
Wy.

PLATE IX.

Summary. The relationships for which a resemblance was noticed were the following: Brother-sister, three times; sister-sister, once; mother-daughter, possibly once; father-son, once; father-daughter, once. No resemblance was noted in the following cases: Brother-sister, twice; sister-sister, once; mother-daughter, twice; father-daughter, once.

The question may be raised in this connection of the effect upon resemblance of similarity in sex and age. That the sex-difference, whether due to social or physiological causes, did influence results somewhat is shown by the fact that the average first place for resemblance was ten out of fifteen times given to a handwriting by one of the same sex and that the same thing occurred nine out of fifteen times in the average for the second

place. A resemblance noticed between two persons of an opposite sex must then be strong enough to overcome this difference. Such resemblances were noticed for 1-7, 5-10, 2-8, 14-15. From previous tests in which a number of persons gave judgments upon the sex of handwriting, I know, for instance, that 14 is a distinctly feminine hand and 15 a distinctly masculine hand. A resemblance to be perceived through this difference is probably worth considering. It may also be of interest to know that 1 and 7 are both judged to be masculine hands and that 5 and 10 are ambiguous in this respect.

The age-factor could have influenced results but little. 3 was young (seventeen years old) and 13 was old (over seventy-five years in age); the others were adults. I have already given reasons for my belief that the immaturity of 3 affected the judgments. It is possible that the age of 13 masked a resemblance to 6. Practice influences handwriting to a great extent and should undoubtedly be considered. It is possible that both the sex and age difference, except that of extreme old age, are reducible to a certain extent to differences in practice.

(D) COLLECTION L.

Collection L is interesting because it contains the handwriting of nine adult brothers and sisters. It also contains two specimens of the handwriting of children whose parents were first cousins. It includes twenty-one numbers, as follows: 1(F), 4(M), 5(F), 6(F), 7(F), 8(M), 12(F), 15(M), 18(M), brothers and sisters; 10(M) and 20(F), son and daughter of 1 and 13; 16(F) daughter of 4; 17(M) son of one of the above; 19(M) son of 12; 11(F) and 27(F), maternal cousins to 1, etc.; 13(M), 23(F), and 26(F), paternal cousins to the same; 25(M), paternal uncle to the same and father of 26; 28(F) daughter of 27 and therefore first cousin once removed to 1, etc.

The following standards were chosen as representative: 1, 5, 11, 13, 20 and 23. As before, ten subjects arranged the series in the order of their likeness to the given standard. 10, 17, 19, and 28 are unformed hands; 7 is a stereotyped hand.

Table XI gives the average results with the mean variations. It reveals some remarkably close resemblances; for example, the resemblance between 4 and 20, 1 and 23, 13 and 8.

TABLE XI.
Collection L. Position averaged from that given by 10 subjects.

Order	Standard 1			Standard 5			Standard 23			Standard 11			Standard 20			Standard 13		
	No.	Position	M. V.	No.	Position	M. V.	No.	Position	M. V.	No.	Position	M. V.	No.	Position	M. V.	No.	Position	M. V.
1	23	2.4	1.48	12	4.4	2.88	4	4.3	2.02	18	4.9	2.28	4	1.9	1.08	8	3.5	4
2	4	4.7	1.9	15	5.3	2.35	12	5.1	2.58	4	5.3	3.04	26	6.5	4.3	27	6.5	4.4
3	6	5.6	2.48	4	5.4	2.88	1	5.4	3.08	12	5.6	3.48	12	6.6	4.12	1	8.2	4.82
4	20	6.1	2.9	23	5.5	2.80	6	6.1	2.7	5	5.7	3.38	15	6.9	3.48	16	8.9	4.1
5	15	6.4	2.4	11	6.9	2.7	15	6.9	2.52	23	5.9	2.72	5	7.1	4.72	25	9.1	5.72
6	12	6.5	3.9	26	7	3.2	26	7.6	3.92	6	6	3.6	1	7.3	2.9	5	9.1	6.22
7	26	9.1	4.12	20	8	3.6	5	7.6	4.48	15	7.2	3.64	23	7.6	2.2	23	9.2	3.4
8	11	9.3	3.56	6	8.1	3.52	11	8	3	26	8.8	3.40	13	9.4	5.08	20	9.5	3.5
9	8	10.3	3.86	1	8.8	3.04	20	8.3	2.5	1	9.4	2.68	11	10.1	5.12	4	9.6	4.2
10	27	10.5	4.2	18	9.3	3.3	18	9.3	3.9	20	9.7	3.3	6	10.2	4.16	18	9.9	4.68
11	18	10.8	4.06	8	10.9	3.7	16	9.7	3.62	27	10	4	27	10.9	3.32	26	10.2	2.6
12	13	11.3	2.3	16	10.9	4.1	27	11.7	2.9	16	11.6	3.92	8	11.3	4.1	6	10.6	3.48
13	5	11.8	3.08	27	11	2.6	8	12.9	4.52	8	12.5	4	16	11.9	4.1	15	11.1	2.9
14	10	14	4.4	13	12.7	3.82	25	13.1	5.3	13	13.2	2.24	19	13.6	2.6	11	11.2	4.6
15	16	14.3	3.64	7	14.3	4.64	13	13.9	1.88	19	14.2	2.12	25	13.8	5.44	17	11.7	4.76
16	25	14.3	4.7	25	15.1	4.46	10	15.3	3.18	25	14.4	4.04	18	14.2	2.92	12	11.8	4.8
17	19	14.6	1.8	19	15.4	1.96	19	15.5	1.9	10	14.8	3	17	14.7	3.04	10	12.2	4.36
18	17	14.8	2.48	17	15.9	2.22	17	16.3	2.04	7	16.1	4.08	10	15	2.8	19	12.6	3.6
19	7	16.4	3.64	10	17.1	2.1	28	16.4	3.64	28	17.3	1.9	7	15.4	4.44	28	14.6	2.88
20	28	16.8	2.00	28	18	1.8	7	16.6	3.28	17	17.4	3.92	28	15.6	2.6	7	19.5	.6

With 20 as standard, 4 received the following positions: 1, 1, 1, 1, 1, 1, 2, 2, 3, 6, average position 1.9. 4 and 20 are doubly related, uncle-niece and cousin once removed. (See Plate X.) 4 also resembles closely 23 (paternal cousin), 5 (sister), and 1 (sister).

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 Dridgeton
 New Jersey
 333 North Laurel St.

No. 4.

Miss Elizabeth M. Loring
 Verona
 New Jersey.
 Essex Co.

PLATE X.

When 1 was used as standard, 23 was assigned the following positions:
1, 1, 1, 1, 1, 2, 3, 3, 5, 6. When 23 was standard, 1 takes the third place. 1
and 23 are paternal cousins. (See Plate XI.)

Miss O. M. Lanning
Verona
(1) Essex County
New Jersey.

Miss E. M. Lanning.
(23) Verona
New Jersey

8 ranks first when 13 is standard. It received the following positions: 1, 1, 1, 1, 1, 1, 1, 1, 11, 16, average position 3.5. The first of the last two subjects, who disagreed so strangely with the majority, when asked some weeks later to arrange the cards according to their likeness to 13 advanced 8 to the sixth position. 13 and 8 are paternal cousins. (Plate XII.)

Mrs Elizabeth Lanning
 Verona Glen Road
 Essex County
 New Jersey
 No. 13.

Mr William H. Lanning
 320 to 326 Ogden st
 Newark
 New Jersey
 No. 8

With 5 as standard the first place was given to 12 (sister) on an average received from the following assigned positions: 1, 1, 1, 2, 3, 4, 5, 5, 9, 13. 12 also resembles 23 (paternal cousin). (Plate XIII.)

Miss Elizabeth Laning
Verona,
New Jersey.
No. 5.

Miss E. M. Laning.
Elmwood Road,
Verona,
New Jersey.
No. 12

18 is most like 11 (maternal cousin). The positions assigned it were 2, 2, 3, 3, 4, 4, 5, 6, 9, 11; average, 4. 9. (Plate XIV.)

Miss Elizabeth M. Lanning
Bridgeton
N. J.
 No. 18

Miss Elizabeth M. Lanning
Verona
New Jersey.
 No. 11

PLATE XIV.

The point of interest is the frequency with which a similarity occurs in the handwriting of persons related in the second or third degree. 20 and 4, which gave the closest resemblance, are unlike in age and opposite in sex, facts which make the resemblance of greater significance.

Several subjects who worked with Collection L made the statement that it was very easy to separate the cards into several groups, but difficult to place the cards within these groups. The averaged results show the effects of such grouping. A study of the table seems to justify the following grouping: 1, 4, 6, 15, 23, 20, 26; 12, 5, 7, and possibly 11 and 18; 8, 13, and possibly 25 and 16. 10, 17, 19, 28 fall out of the series; they are too unformed to furnish a basis for judgment. 27 seems also to fall out of the series. 7 is placed with 12 and 5 because its position is advanced several grades when 5 is selected as standard. It is questionable whether 11 and 18 should also be placed in this group. But a transition from the first group to 11 and 18 can be made through 12 and 5.

The possibility of such a grouping is of great importance. It is just such a separation into groups that the analytical method of study of inheritance would demand as preliminary to a determination of unit characters. A more complete record would be needed before one could draw

any definite conclusions from the present grouping. But it is interesting to note the indications, among these nine brothers and sisters, of the existence of two writing-types on the paternal side, one on the maternal, and a fourth type that seems transitional.

IV. GENERAL CONCLUSION.

The experiment herein reported is, as the title indicates, strictly a preliminary study. It has only suggestive value. For this reason no elaborate manipulation of returns has been attempted.

It shows that a judgment on resemblance in handwriting is, to a high degree, subjective and that, consequently, an unsupported judgment is of little value. At times, however, a resemblance may be so strong as to overbalance this subjectivity. In general, a judgment of unlikeness is made with greater ease than one of likeness.

In view of the subjectivity of this judgment, it is desirable that some objective criterion be established for the measurement of the so-called "character" of handwriting. The tests gave, however, no satisfactory conclusions as to what constituted character or individuality in handwriting. Many details were found to be influential, such as slant, pressure, formation of letters, size, and texture, but beyond these there was something not always determinable and called "general appearance." Careful measurements must in time analyze this general appearance if progress is to be made.

The use of letter-superscriptions as the material on which judgments are passed is convenient but subject to criticism in that the material is scanty and the writing of an address apt to be unduly formal. So much must be granted. In a complete investigation an examination of one or more manuscripts should supplement such observation as is described above.

It has been seen that age influences writing to a great extent. The writing of the very young and of the very old is easily selected. The results of the present test show that the writing of children can hardly be compared with that of adults. Sometimes, it is true, very interesting resemblances came out, but frequently the hand is too uncertain or too conventional to be worth consideration. The writing of some young people, however, sets at an early age. This in itself seems to be a family characteristic of some importance. I have one family collection in which the hand of at least three of the five children is distinctly formed at the age of thirteen; the hand of one has shown no variation for fifteen years. In other families the handwriting is not formed until after twenty. When the handwriting of very old people is used in a comparison with that of others, the observation should, if possible, be checked by reference to earlier work.

Difference in sex undoubtedly introduces a difference in handwriting, particularly in youth, at which time the girl's writing is strongly conventional, a conventionality which persists unless overcome by the habit of much writing, or by the advance of age. Although a resemblance between two handwritings may be masked by the sex difference, a resemblance in handwriting between two who are opposite in sex may be so great as to overcome this difference.

The most important conclusions from the study may be briefly summarized as follows: (1) A very striking resemblance often exists between the handwriting of different members of the same family. (2) This resemblance cannot be accounted for on the ground of similarity in educational and social influences for it is frequently found in the case of relatives who have had different training, been under different environmental conditions, are very different in age and unlike in sex. (3) A resemblance